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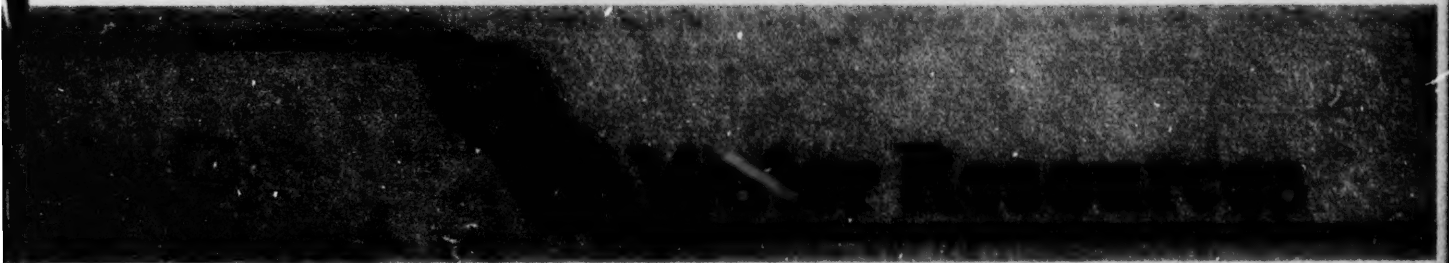
# COLD LAKE - BEAVER RIVER WATER MANAGEMENT STUDY

## VOLUME 4
## FISHERIES

Appendix F . . . . . . . . . . . Fisheries Studies; Main Report
Appendix G . . . . Fisheries Studies; Detailed Data Report



Alberta
ENVIRONMENT
Planning Division

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# COLD LAKE — BEAVER RIVER
# WATER MANAGEMENT STUDY

## VOLUME 4
## FISHERIES

PREPARED BY
PLANNING DIVISION
ALBERTA ENVIRONMENT
December 1983

Submitted to: Hon. F. Bradley
Minister of Environment

APPENDIX F

# FISHERIES STUDIES; MAIN REPORT

A Report Prepared By
AQUATIC ENVIRONMENTS LIMITED

**AQUATIC
ENVIRONMENTS
LIMITED**

***biological consultants***

10 December 1983

Alberta Environment
Planning Division
9th Floor, Oxbridge Place
9820 106 Street
Edmonton, Alberta

Attention: Ron Hicks

Dear Ron:

We are pleased to submit to you our report entitled "Fisheries Studies Cold Lake-Beaver River Study Area - Volume I Review of the Potential Effects of Water Level Fluctuation on Fish Populations in Waterbodies in the Cold Lake Region".

If you have any questions regarding this report, please feel free to contact me at our Calgary office (403-276-8171).

Sincerely,

AQUATIC ENVIRONMENTS LIMITED

Peter McCart, PhD
President

PM/ksd
Encl.

1235A - 40th Avenue N.E., Calgary, Alberta T2E 6M9 Phone (403) 276-8171

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# 1.0 INTRODUCTION

This volume, Volume I of a report entitled Fisheries Studies, Cold Lake-Beaver River Study Area, is a review of the potential effects on water level fluctuation on fish populations in waterbodies in the Study Area. Volume II, entitled Detailed Data Report, Fishery Surveys, Cold Lake-Beaver River Study Area (Ferrari et al. 1982), presents data describing fish populations of nearshore areas in selected lakes and streams in the Cold Lake Region. The locations of the waterbodies included in the study are indicated in Figure 1. All are under consideration as possible sites for regulation to provide additional supplies of water to a a variety of industrial developments in the area. For this reason, the report also includes a brief assessment of the potential impacts of water level regulation on fish population in each of the study lakes (though not in the study streams as this was the responsibility of Fish and Wildlife Division, Alberta Department of Energy and Natural Resources).

# 2.0 LAKES

## 2.1 Distribution of Species

Table 1 lists those fish species which have been recorded in those waterbodies, lakes and streams, included in the study. Two qualifications must be made; first, the list includes only those species of Cold Lake, and does not include those which might be encountered in Cold Lake as a whole; and second, one species, the river shiner (Notropis blennius), though provisionally identified in the field in Jackfish Creek and Sand River, was not subjected to a detailed, corroborative examination in the laboratory. The identification should, therefore, be regarded as tentative as the species has not previously been reported from the Churchill Drainage (Scott and Crossman 1973).

Table 2 summarizes information describing the presence or absence of fish species in lakes. The species lists for each location are those available to date, and are based on the results of the surveys conducted in 1981 (Ferrari et al. 1982) and on information in Cross (1979), and the files of the Fish and Wildlife Division. For some locations, the indicated species representation should be considered minimal. Caribou Lake, for example, which lies within the Canadian Forces Air Weapons Range, has only been visited infrequently, for short periods, because special permission is required.

McCart et al.(1979) have described generalized, positive relationships between both mean depth and lake area and the number of fish species in lakes in the Cold Lake Region. The same tendencies are apparent among those lakes sampled during the 1981 survyes and the larger, deeper lakes (Cold, Ethel, Marie, Moose, Muriel, and Wolf) do indeed have the largest representations, 10 or more, of fish species (Table 2). Note that the data for Cold Lake are for Long, Centre, and French Bays only and that the lake as a whole, by far the largest in the region, has a total complement of 23 species (McCart et al. 1979).

Among the study lakes (Table 2), two of the most widely distributed species are the northern pike (all 11 locations) and the yellow perch (10 locations), both economically important species. Other economically important species which are well represented in lakes are the whitefish (8 locations), yellow walleye (8 locations), and lake cisco (6 locations). Of these species, lake whitefish and lake cisco are taken almost exclusively by commercial fisheries; northern pike and walleye by both commercial and sports fisheries; and yellow perch primarily by sports fisheries. The burbot, a species which enters incidentally into both commercial and sports catches, but which is not much sought after, is also well represented (8 locations) in lakes in the Study Area.

Many of the lakes included in the study have been fished commercially (Table 2). With two exceptions, such fisheries are conducted annually. The exceptions are Marie Lake, which has only been fished occasionally in recent years (most recently in 1981), and Ethel Lake, which is fished only in alternate years.

The most widely distributed of the non-economic species in lakes (Table 2) were the white sucker (10 locations), the spottail shiner

(8 locations), two species of sticklebacks, and the Iowa darter (7 locations each).

## 2.2 Relative Abundance of Species

Because of wide variability in the susceptibility of fish species and life history stages to differences in sampling gear and to differences in habitat type in the sampling area, relative abundance is difficult to establish with any certainty. In the lake surveys conducted in 1981, the emphasis was on obtaining information on fish populations in shallow water, within the zone of water level fluctuations likely to occur as the result of lake regulation. For this reason, almost all sampling in lakes, by whatever means, was done in waters 1.5 m depth or less (Ferrari et al. 1981). Tables 3, 4, and 5 summarize effort, catch per unit effort, and the proportion of the total catch represented by each species for minnow seine, beach seine, and gillnet, respectively, for each of the 1981 survey lakes.

Minnow seines (Table 3) tend to select for small forage species, such as shiners, as well as for the young-of-the-year and smaller juveniles of large species. While there was considerable variation among individual lakes, overall, the most abundant species in minnow seine catches were the spottail shiner (36.4%), the yellow perch (21.6%), the Iowa darter (15.3%), and the northern pike (8.7% overall, but quite variable among lakes). Other species which were locally abundant were the fathead minnow (56.8% of catches in bays adjacent to Cold Lake), white sucker (13.4% in Wolf Lake), brook stickleback and ninespine stickleback (33.5% and 33.3%, respectively, in Manatokan Lake).

Beach seines (Table 4) can be used to sample somewhat deeper water than minnow seines and, because of their typically larger size and larger meshes, select for somewhat larger fish, including the larger juveniles and some adults of economically important species. In the survey lakes, yellow perch were by far the most abundant species in beach seine catches (57.6% overall, ranging from 30.2 to 95.2% at individual localities). Spottail shiners accounted for 17.5% and northern pike for 10.4% of beach seine catches overall, with considerable variation from lake to lake. Again, several species were locally abundant including the white sucker (32.6% in Marie Lake), yellow walleye (10.5% in Moose Lake), and Iowa darter (17.6% in Muriel Lake). Two economically valuable species which were absent from minnow seine catches did occur in small numbers in beach seines—lake whitefish and lake cisco.

Gillnets (Table 5) are generally inefficient in catching small forage species and the smaller juveniles of larger species, and tend to be selective for large individuals including suckers and the economically important species. Among the 1981 survey lakes, the most abundant species was the northern pike, 50.7% overall and well represented (13.4 to 86.5%) in each of the six lakes in which gillnets were set. Other important economic species, though more variable from lake to lake, were yellow perch (19.0%), lake whitefish (10.3%) and yellow walleye (4.3%). The only small forage species with even a moderate representation (8.1% overall) was the spottail shiner, the result of a single large catch at Burnt Lake. Of the large coarse species, the white sucker was the only one represented in gillnet catches (7.1% overall).

A consideration of all the data for the three types of fish sampling gear (Tables 3 through 5), suggests that the economically important species most abundant in the nearshore zone of the study lakes are the northern pike and yellow perch. Among non-economic species, the spottail shiner and Iowa darter are the most abundant of the forage species and the white sucker of the larger coarse species.

## 2.3 Assessment of Potential Impact on Fish of Water Level Regulation in Lakes

### 2.3.1 Some General Considerations

#### 2.3.1.1 Scenarios

For each lake included in the study plan, we have been asked to consider two basic approaches to water level regulation.

The first would involve lowering the sill at the lake outlet. This approach would have little effect on maximum water levels in the lakes, which would remain much as they are now, but would appreciably lower minimum levels. Under this approach, we have been asked to consider three scenarios: decreases in water levels of 0.2, 0.5, and 1.0 m.

The second approach would involve establishing a weir at the lake outlets which, in effect, would raise the level of the sill. Under this regime, maximum water levels would increase, but minima would be unaffected. Again, three scenarios were considered, involving increases of 0.2, 0.5, and 1.0 m.

#### 2.3.1.2 Effects on Nearshore Habitats

Potential effects of the various scenarios on the land-water interface were assessed in a document prepared by C. McGregor of the Resource Appraisal Section, Alberta Energy and Natural Resources, Edmonton. McGregor's findings are difficult to apply directly to fisheries questions but it appears that, in general:

1. For those scenarios involving increases in lake level, there will generally be increases in erosion and fallen tress, and decreases in the extent of emergent vegetation. In most zones, these effects are negligible at the lowest level of fluctuation (0.2 m), but increase as the degree of change in water level increases.
2. For those scenarios involving decreases in lake level, there will generally be increases in the extent of the lake margin zone, of ice scour and bare ground, together with a decline in (or elimination of) the zone of emergent vegetation. Again, these effects are greatest at the highest level of fluctuation (1.0 m).

### 2.3.1.3 Effects on Water Quality

At a meeting on 12 February 1982, the water quality expert, D. Trew, Alberta Environment, discussed some of the potential impacts of lake regulation on water quality in lakes. He suggested that the following may occur:

1. Increases in nutrient concentrations as a result of either the flooding of terrestrial soils at higher water levels or the mineralization of exposed lacustrine soils at lower water levels. Both effects may be temporary, lasting only a few years; but, at least in the short term, will result in increased primary productivity and algal blooms. This increased productivity may, in turn, reduce oxygen concentrations in deep water during both the summer period of lake stratification and under winter ice.
2. Increases in sediment loads as a result of the wider range of fluctuations in lake level. An examination of C. McGregor's data suggests that this may be more a problem at higher water levels, when erosion of shorelines and tree falls are common, than at lower ones. Increases in turbidity, by limiting light penetration, might partially offset the increases in primary productivity resulting from increased nutrient loading.

### 2.3.1.4 Sensitivity of Fish Species

The following is a brief assessment of how water fluctuations in lakes might affect several target species or groups of species.

## Forage Species and Yellow Perch

In the study lakes, forage species (i.e. those which are not economically important in themselves, but which are preyed upon by piscivorous species such as northern pike, burbot, and yellow walleye) include the various minnows (Family Cyprinidae), juvenile suckers (Family Catostomidae), the sticklebacks (Family Gasterosteidae) and the darters (Family Percidae). The yellow perch is, in many respects, like the forage species. It occupies similar habitats and, like the forage species, is an important prey of other species, especially yellow walleye with which it is frequently associated.

These species use the warm, weedy, nearshore shallows as rearing areas for young-of-the-year and juvenile fish, and as spawning and feeding areas for adults. They seem to prefer areas of aquatic weeds. Water level fluctuations which eliminate these areas would probably adversely affect populations of many of these species. In addition, fluctuations may adversely affect their food supply by alternately flooding and dessicating the substrates on which benthic macroinvertebrates grow. Overall, these species would likely be least affected by:

1. Small, rather than large, changes in water levels--that is, by changes close to 0.2 m rather than 1.0 m. In many habitat zones, the effects of a 0.2 m change, especially increases, are negligible.
2. Increases rather than decreases in water level. In some lakes, even small declines in water level will eliminate a considerable area of the shallow waters favoured by these species. Increases, in

> contrast, sometimes add considerably to the area of shallow water available. It is not possible to determine the level, if any, at which the effects of habitat degradation might be counterbalanced by the increased area of shallow water available.

## Lake Whitefish

Machniak (1975a) has assessed the literature regarding the effects of water level manipulation on lake whitefish populations. He notes that:

> 1. Although fluctuations in water levels that occur after spawning is completed can cause serious egg losses through exposure, lake whitefish can spawn over a wide range of depths and, overall, they are more tolerant of such effects than are spring-spawning species.
> 2. Spawning success might also be adversely affected by siltation from reservoir margins and by reduced oxygen levels.
> 3. The increased siltation might adversely affect the feeding success of larval whitefish which are known to be affected by light conditions.

The spawning areas of lake whitefish in the study lakes are not known, but in Muriel Lake, in the Cold Lake Study Area, lake whitefish eggs have been found at depths between 0.6 and 4.0 m (Aquatic Environments Limited, file data).

The maximum depth at which eggs of this species occur is not known, but some are certainly within the zone of maximum drawdown (1.0 m) postulated in the scenarios. An even larger proportion is within this zone plus the maximum likely depth of ice (also 1.0 m) which might form in the lake and settle on or scour eggs in the lake substrates.

It seems likely that, with regard to water level fluctuations, a lowering of lake minima will have a greater adverse effect on reproductive success in lake whitefish than an increase in lake maxima. In contrast, the potentially adverse effects of siltation are likely to be greatest at high water levels when erosion and siltation, which may affect both reproductive success and larval growth, are expected to be maximal.

While, as Machniak (1975a) points out, the effects of reservoir development on some aspects of the biology of this species are ambiguous and purely speculative, it would be our assessment that overall, lowered water levels are more likely to have serious adverse effects than heightened ones. In fact, moderate increases in water levels may have little, if any, effect on lake whitefish.

## Northern Pike

This spring-spawning species, which spawns in very shallow water (usually 0.5 m or less), is thought to be more susceptible to water level drawdowns during the spawning and incubation period than those species which tend to spawn in somewhat deeper water (e.g. the spring-spawning walleye and the fall-spawning lake whitefish). Machniak (1975b) concluded from his review of the literature that, in reservoirs:

1. If water levels are rising and are maintained at a high level during the spring, pike spawning is generally highly successful.
2. If, on the other hand, water levels are low or dropping during the spawning and incubation season, pike reproduction is generally poor.
3. Pike reproduction is often highly successful during the initial filling of a reservoir, but declines and becomes inconsistent as the reservoir ages and spawning success deteriorates and forage species decrease.

With regard to these observations, Machniak (1975b) notes that pike are adapted to spawning in shallows, on the previous year's vegetation, and that absence of vegetation is probably the main factor limiting reproduction in this species. Overall, pike would be expected to produce the strongest yearclasses in situations where:

1. Water levels were higher than natural ones rather than lower.
2. Where changes in water level were minimal (0.2 m) rather than maximal (1.0 m) to minimize destruction of aquatic vegetation.
3. Where the attainment of high spring levels preceded the spawning period and were stable during the period of incubation and the early free-swimming period.
4. Where the regulatory regime allowed for the occasional very high water level during the reproductive period, for example, once very five years.

Overall, the northern pike might be the best single target species to consider in assessing and mitigating the effects of lake regulation in the Cold Lake Study Area. It is closely associated with the shoreline, is apparently quite sensitive to the effects of lake level fluctuations, it is important economically and it is the one species found in every waterbody surveyed in 1981. Any regulatory regime which allows for the continued well-being of pike populations is likely to have few effects on other, less sensitive, species.

## Yellow Walleye

Machniak (1975c) notes that, in most reservoirs, walleye spawn in water less than 2.0 m in depth, and it has been shown that water level fluctuations during the reproductive period have a negative effect on populations of this species. They do best where attempts are made to maintain fairly stable or slightly rising levels during their spawning and incubation period in the spring; and, over the long term, they generally do better in reservoirs than do shallower water spawners such as pike. Walleye reproductive success can, however, be adversely affected by siltation.

Outside of the reproductive season, walleye appear to be quite tolerant of reservoir drawdown. Some studies (reviewed by Machniak 1975c) indicate that, in time, walleye populations in reservoirs tend to increase while those of pike decline. Walleye success is often correlated with that of yellow perch, their favoured prey item. The latter often do well in reservoirs, where flooded brushy areas provide good spawning habitat.

Overall, it would seem that walleye would be less affected by reductions in water levels than some other species such as the pike and some of the forage species. Nevertheless, even for this species, those scenarios which involve increased water levels would seem to be preferable.

### 2.3.2 Assessment of Impact on Individual Lakes

The following assessments of the potential impact of water level regulation on fish populations in the Cold Lake Study Area are based on the results of the 1981 fisheries surveys; on an assessment of other available fisheries information; on detailed morphological information supplied by Alberta Environment, Planning Division; and on information on changes in nearshore habitats likely to result from the various scenarios (based on information supplied by C. McGregor, Alberta Energy and Natural Resources, Edmonton). In each case, six scenarios were entertained involving changes in water levels of 0.2, 0.5, and 1.0 m above and below the current median value.

Table 6 provides data describing the area mean depth and total dissolved solids concentrations in the study lakes together with a calculation of the morphoedaphic index (Ryder et al. 1974), a parameter which is correlated with commercial fish yields in lakes in the Cold Lake Region (McCart et al. 1979).

### 2.3.2.1 Angling Lake

Angling Lake is relatively deep (11 to 12 m) for its size, but it is ringed by extensive shallows. As a result, a reduction of 1.0 m would reduce the total area of the lake by about 21%. C. McGregor notes that the silty margins are ideal for plant growth, which occurs up to 180 m from the lake margin. He suggests that the lake is quite susceptible to lowering of levels, especially beyond 0.2 m, with the reduction or elimination of important nearshore communities. Increases will cause some flooding, but this will not be extensive at levels 0.5 m or less.

The only economic species present in Angling Lake are northern pike, burbot, and yellow perch. The spottail shiner is the only forage species so far identified. There is probably a small recreational fishery associated with the campground along the lake margin. The lake has been commercially fished for northern pike over the last several years.

Total catch per unit effort, for both minnow seine (Table 3) and gillnet (Table 5), were the highest recorded during the 1981 surveys, but those of beach seine (Table 4) were among the lowest. The lake is probably quite productive, but there are insufficient data to calculate a morphoedaphic index (Table 6).

Because of the sensitivity of the aquatic communities in shallow water along the lake margin, water levels in Angling Lake should not be reduced. Increases to at least 0.5 m might be beneficial, especially if seasonally manipulated to benefit pike. Caution is required, however, because of the problem of increased nutrient loadings on the primary productivity of such shallow lakes. Further water quality data are required to determine the trophic status of the lake and its susceptibility to winter kill.

### 2.3.2.2 Burnt Lake

Burnt Lake lies in a shallow depression and extensive flooding of waterbodies and some erosion will occur with a 1.0 m rise in water levels. A reduction of even 0.2 m in water levels is likely to eliminate the emergent zone (C. McGregor).

This lake supports a commercial fishery for lake whitefish. Northern pike, yellow perch, and walleye, together with a variety of forage species, all frequent the shallow waters of the lake. During the 1981 surveys, only gillnet sampling was conducted in this lake. Total catch per unit effort was relatively high (Table 5), second only to that in Angling Lake. The principal species captured were, in order, spottail shiner, yellow perch, yellow walleye, and northern pike. No morphoedaphic index could be calculated (Table 6), but the lake is probably quite productive of fish.

Scenarios involving water level decreases in Burnt Lake should be avoided. Even a 0.2 m decline in water levels, by eliminating the emergent zone, will probably have a serious adverse impact on warmwater game species, particularly northern pike and yellow perch.

Scenarios involving water level increases have less serious consequences and, in the short term, may benefit species such as pike and yellow perch. There may also be longterm benefits resulting from the absolute increase in nearshore aquatic habitat, provided the periodicity of fluctuations is controlled to benefit fish. Criteria for the kind of reservoir operation which might benefit northern pike populations are outlined in Section 2.3.1.4.

Overall, then, the optimal regimes are those which raise mean water levels. At Burnt Lake, an increase of even as much as 1.0 m may be beneficial because it would not interfere with other human uses and would appreciably increase (by about 13 %, most of it quite shallow water) the total area of the lake.

#### 2.3.2.3 Caribou Lake

Caribou Lake is very shallow and lies in an area of low relief so that increases or decreases in water levels have a marked effect on the area of the waterbody. An increase in water levels of 1.0 m above that recorded in October 1981 would increase the area of the lake by about 45%; a decrease of 1.0 m would decrease the area by about 52%.

Obviously, any fluctuation from normal lake levels is likely to cause major changes in biota, particularly if, because of the limited storage capacity of the lake, water level fluctuations occur relatively rapidly. Decreases will result in marked reductions in the area of aquatic habitats, and increases will result in the flooding of existing phreatic and uplands zones with some erosion.

Little is known about fish populations in Caribou Lake, but, because the lake is very shallow (Table 6), they are not expected to be very well developed or productive. No morphoedaphic index can be calculated. There is no commercial fishery and it is unlikely that the lake is fished very often by anglers. Both pike (to 600 mm in length) and white sucker, but no other species, have been captured by gillnet in this lake.

Because a decline in the water level of Caribou Lake would severely reduce available habitat and may create problems for overwintering fish, none of the scenarios involving decreases is acceptable.

Scenarios involving increases in water levels will probably result in the flooding of nearshore vegetation. In the short term, the release of nutrients from newly flooded soils will undoubtedly benefit pike and white sucker populations. In the long term, however, pike populations may decline unless the regime meets the criteria outlined for pike in Section 2.3.1.4. In this instance, the maximum increase in depth, even beyond 1.0 m is probably the most beneficial, especially if it can be combined with the optimal regime.

### 2.3.2.4 Cold Lake (Long Bay Complex)

Only the Long Bay Complex (including Long, Centre, and French Bays) has been assessed. The bay and its shoreline have been described by C. McGregor as "...very susceptible to increases and decreases in water level." His information indicates that, in general, decreases in water levels will result in declines in the area of emergent vegetation; and that increases will result in declines in, or the elimination of, the area of the phreatic zone with, however, some increase in the area of emergent vegetation.

The maps which have been supplied as background material indicate that, with water level decreases, there will be a marked reduction in the area of the complex. A decrease of 0.5 m, for example, will mean the loss of all the shallow complex inner reaches of Long Bay, as well as a significant proportion of Centre Bay and the shallow western margins of French Bay.

Overall, then, even moderate decreases in water levels would appear to have a significant impact in reducing the area of nearshore aquatic habitats in the Long Bay Complex, while increases in water levels will increase the area of such habitats. Because the rates of seasonal water level fluctuations are likely to be similar to those occurring under natural conditions, relatively normal aquatic floral communities might be expected to develop under scenarios which involve increases in water levels.

The Long Bay Complex is a shallow, warm, productive habitat quite different from the cold, relatively unproductive habitat characteristic of Cold Lake proper. It is probably considerably more productive than the main body of the lake which is deep, cold and oligotrophic with a very low value for the morphoedaphic index (Table 6 and McCart et al. 1979). Whereas the fish fish fauna of the lake is dominated by fall-spawning coldwater sport and commercial species (lake whitefish, lake cisco, lake trout (McCart et al. 1979), the fish fauna of Long Bay is dominated by spring-spawning warmwater sport and commercial species. Among the latter, in order of their representation in gillnet catches, are northern pike, yellow perch, and yellow walleye, together with a variety of forage species.

For northern pike and yellow perch, the Long Bay Complex is probably the single most important spawning and rearing area associated with Cold Lake. Its importance to walleye is still somewhat questionable. While mature walleye do occur in Centre Bay in the spring, it is not definitely known that they spawn there, and juveniles are only occasionally taken. Adults may use the area for feeding in the spring, but spawn elsewhere on rocky reefs. The question of the utilization of Centre Bay by walleye should be resolved before any major development takes place in this area.

Because the inner portions of the Long Bay Complex are extremely shallow, any decrease in the water level will have a significant adverse effect on the availability of warm, heavily vegetated, shallow water habitat. Such habitat is important to two major sports species in the bay, northern pike and yellow perch, and populations ot these two species would be expected to decline. Walleye populations might also be adversely affected either directly if, in fact, they spawn in the bay; or indirectly if, as is true throughout much of their range, the early success of walleye year classes, at least in part, is dependent on the abundance of their major prey, young-of-the-year yellow perch.

Increases in water levels, in contrast, would increase the availability of shallow, warm, well-vegetated habitat, a type which is at a premium in waters associated with Cold Lake, and would probably benefit northern pike, yellow perch, and possibly, walleye.

In summary, water level declines will probably have adverse effects on populations of major fish species in the Long Bay Complex, while increases, by increasing the availability of suitable habitat, may benefit them. We have, as yet, no basis for assessing the level of increase which might be optimal, but, with regard to the warmwater fish fauna which dominates the bay, it should be one which maximizes the area of shallow water occupied by aquatic vegetation. Whatever the scenario, the rate of change in water levels should be such that a normal aquatic flora can develop.

We would caution that any plan to increase water levels in Cold Lake will presumably involve a water level control structure on the Cold River in Saskatchewan. The Cold River is a migration route for fish and is also used by spawning lake whitefish, especially downstream of Primrose Lake. The well-being of the whitefish population will require the maintenance of adequate winter flows.

### 2.3.2.5 Ethel Lake

Predictions of the probable effects of water level changes on various shoreline types (C. McGregor) indicate that:

1. Water level increases will result in beach upland flooding, declines in phreatic vegetation, and increased erosion.
2. Water level decreases will result in some increase in ice scour, some increase in beach areas, and extensive reductions in the area of emergent vegetation. The shallow southeast bay is thought to be especially sensitive to the lowering of water levels.

Ethel Lake supports a small, alternate-year, commercial fishery focussed on lake whitefish. Lake cisco are also abundant. Among warmwater sports species, northern pike and yellow perch are common and are exploited by sports fishermen from surrounding towns. Some walleye also occur.

Catches per unit effort for minnow seines (Table 3) and beach seines (Table 4) were both relatively high. Yellow perch were by far the most abundant economic species in catches made in 1981; spottail shiner, Iowa darter, and white sucker the most abundant forage and coarse fish. (No gillnet sampling was permitted in this lake.) The morphoedaphic index (26.2, Table 6) is in the middle range for lakes in the area.

Decreases in the water level of Ethel Lake will eliminate a large proportion of the warm, shallow, weedy habitat important to pike and perch as well as a variety of forage species. At levels 0.5 m or more below the existing mean, the southeast bay would be cut off from the rest of the lake, including the lake outflow. This reduction in the area of shallows, together with extensive reductions in the area of emergent vegeation, would probably have major adverse effects on these species. Whitefish and cisco, which tend to be found further offshore and in deeper water, would be less affected, if at all. Overall, however, fish production would be expected to decline.

At increased water levels, there will be declines in the area of phreatic vegetation presumably compensated, at least in part, by an increased area of emergent vegetation. The absolute area of productive shoreline will be increased, but the rate of productivity may be reduced by the widespread erosion which is predicted. Especially at high water levels, erosion produces sediment, reducing light penetration and smothering algae, higher plants, benthic food organisms, and the eggs and larvae of fish.

Ethel Lake is another lake in which the impact of decreased water levels appears to be much worse than that of increased levels. For Ethel Lake, we would opt for increases in water levels in the low (0.2 m) to moderate (0.5) range.

### 2.3.2.6 Manatokan Lake

C. McGregor describes Manatokan Lake as having a very shallow (0.2 to 0.5 m) bay to the east which contains a lush growth of aquatic macrophytes and emergent vegetation. The shallow south shore is also dominated by similar vegeation. The maximum depth of the lake is only about 5.0 m and a reduction of 1.0 m in depth would reduce the total area of the lake by about 40%.

The surrounding area is largely low relief agricultural land and an increase in water levels of 1.0 m would increase the total area of the lake by about 36%. The lake, especially the shallow east bay, is very sensitive to water level changes. Increases beyond minimal levels would lead to increased erosion and fallen trees; decreases at any level would lead to significant reductions in the area occupied by aquatic plant communities.

Yellow perch, which are very abundant, and northern pike are the only economic species reported from Manatokan Lake (Tables 2, 3, and 5). The most abundant non-economic species appear to be two species of stickleback and the white sucker. Minnow seine and beach seine catches per unit effort are in the moderate to high range (Tables 3 and 4), suggesting that the shallow water zone is relatively productive. No value is available for the morphoedaphic index (Table 6). There is a summer campground on the lake and a small sports fishery. There is no commercial fishery.

Any decreases in water levels in Manatokan Lake would have severe adverse consequences for fish and should be avoided. Increases might be acceptable and even beneficial to fish, but there is a possibility that nutrient leaching could lead to markedly increased productivity and winter kill, particularly as some of the area which would be inundated is now farmland. More information on existing oxygen conditions is required. If the lake is developed, water levels should be manipulated as recommended elsewhere in this report (Section 2.3.1.4) to encourage the successful spawning of the pike population.

### 2.3.2.7 Marie Lake

Marie Lake has a relatively stable level, with a range of only ±0.3 m over the last 20 years. The lake has a small area (5% of the total) of shallow water less than 1.0 m in depth. Water level decreases will increase the width of the lake margins and beaches and result in some loss of emergent vegetation. Increases will lead to the elimination of some beaches, to erosion, and to tree fall. In each instance, these tendencies will be greatest where the changes in water levels are greatest.

The most abundant of the major species in Marie Lake are probably the lake whitefish, which has supported a commercial fishery, though not in recent years, and the lake cisco. Both species tend to be distributed offshore and in deeper water. The area of shallow water is relatively small in relation to the area of the lake, and warmwater sports species do not appear to do as well as in some of the smaller, shallower lakes in the Study Area. Neither northern pike nor yellow walleye appear to be very abundant and neither species was taken in seine hauls (Tables 3 and 4). Populations of the latter are though to have declined considerably in recent years. The commonest sports species in the shallow waters is the yellow perch (Tables 3 and 4). The commonest non-economic species are the spottail shiner, white sucker, and Iowa darter. Both minnow and beach seine catches per unit effort are among the lowest of any of the lakes surveyed (Tables 3 and 4) and the morphoedaphic index is also very low (Table 6) suggesting that the lake is not highly productive of fish.

In Marie Lake, we would be most concerned about decreases in water level. A decrease of even 1.0 m below the mean historical water level would only decrease the total area of the lake by about 5%; however, that 5% decrease in lake area might have an appreciable effect on the already limited availability of the shallow water habitat important to warmwater sports species and to forage fish. Any marked decline in the available area of shallow water, coupled with the reduced area of emergent vegetation, would be expected to adversely affect populations of these species.

It would seem that, because of the configuration of the lake basin and the surrounding terrain, increases in water levels are unlikely to add appreciably to the area of shallow water surrounding the lake. There may be some short-term benefit to species such as the pike and yellow perch with the flooding of willows and other semiaquatic vegetation and from the falling of trees. In the long term, however, these benefits are likely to be more than counteracted by a reduced area of emergent vegetation and by erosion, especially at the highest level (1.0 m).

In Marie Lake, the overall assessment is that:

1. Increases in water levels are preferable to decreases.
2. Increases at low to moderate levels (0.2 to 0.5 m) are preferable to higher ones;
3. The adverse impact of any change in water levels can be mitigated if, first, levels rise rapidly in the spring and remain stable during the spawning and incubation period of spring spawning species (such as pike and perch); and second, any subsequent changes are relatively slow.

It should be noted that there is a possibility that pike spawn in the outlet of this stream and fish passage past a flow control structure must be a concern.

### 2.3.2.8 May Lake

In May Lake, water level decreases will result in reduction or elimination of the emergent zone together with some increase in the area of beach. This effect will be greatest with a 1.0 m decrease and least with a 0.2 m decrease. Water level increases will result in flooding of the phreatic zone, increased erosion alongshore, and fallen trees. Again, these effects will be greatest at the highest levels of increase (1.0 m) and least at the lowest level (0.2 m).

May Lake is a Trophy Lake for northern pike, and special restrictions on sport fishing apply. To protect the pike no permits for general surveys of fish populations in the lake are granted, and there appears to be little information regarding other species. The morphoedaphic index for the lake is 24.6 (Table 6) suggesting that it is at least moderately productive of fish. Obviously, the major concern in assessing impact in this lake must be its unique pike population.

The pike is a spring-spawning species which spawns in very shallow water (usually 0.5 m or less) and is thought to be especially susceptible to water level drawdowns during the spawning and incubation period. Pike are adapted to spawning on the previous year's vegetation, and absence of vegetation is probably the main factor limiting reproduction in this species (Section 2.3.1.4).

What is known of the life history of pike would suggest that all scenarios involving declines in water levels would be detrimental. So too would any scenarios involving increases which would lead to the eventual elimination of nearshore vegetation. Of the scenarios presented, the safest is probably that which involves a 0.2 m increase in water levels. For most shoreline types, this scenario will result in either no, or very little, change. This scenario might even be beneficial to pike if the rise in spring water levels can be timed to coincide with spawning and incubation, flooding optimal spawning habitat.

On the other hand, the trophy status of pike in this lake suggests that it might be best to leave well enough alone and to look elsewhere for water sources. Indeed, the fact that pike grow very large in the lake might reflect poor spawning and incubation conditions for this species. Those that survive may grow very well because there are few others of the same species to provide intraspecific competition. Improved conditions for spawning and incubation might actually reduce the growth of individuals so that none reach trophy size.

In summary, decreases in water levels will probably be detrimental. A small increase to 0.2 m may have little effect and even increase year class survival for pike. Increased survival may, however, reduce growth rates as the result of increased intraspecific competition, eventually eliminating the trophy-sized fish. Because of its special trophy status, May Lake should probably not be considered for development.

### 2.3.2.9 Moose Lake

Moose Lake has a relatively large area of shallow water, especially the complex bay in its southwest corner. A reduction in water level of 1.0 m would reduce the total area of the lake by about 27%. C. McGregor indicates that aquatic and emergent vegetation are lush, especially in the southwest bay, but are confined to within about 100 m of shore elsewhere. He notes that any reduction in water levels will change the southwest bay and aquatic zones will be markedly reduced. Any increase in water levels above 0.2 m will result in erosion with the elimination of or reductions in emergent vegetation.

Moose Lake has a relatively high value for the morphoedaphic index of 70.6 (Table 6) and supports populations of lake whitefish, northern pike, yellow perch, and walleye. Catch per unit effort in minnow seines was the second highest (Table 3) and in beach seines, the highest (Table 4) of the lakes surveyed in 1981. Overall, the lake seems highly productive of fish. There is a commercial fishery, primarily for lake whitefish, though lake cisco, northern pike, and yellow walleye are also taken. The lake, which is close to Bonnyville, has the largest cottage development of any lake included in the Study Area and provides an important recreational fishery for warmwater species.

Any decrease in water levels will have an adverse effect on the shallow southwest bay, most of which is already less than 1.5 m deep. The area occupied by emergent vegetation will be reduced with a 0.2 m decline and largely eliminated with 0.5 and 1.0 m declines. Even moderate declines would probably have an adverse effect on such species as pike, yellow perch, and, probably to a lesser extent, walleye. Water level increases might be less damaging to fish populations, but would involve considerable erosion and elimination of beach areas even at relatively low levels.

Overall, aquatic communities in Moose Lake seem to be sensitive even to small to moderate increases in levels, up or down. In view of its importance for recreational fishing, it might be best preserved as it is. If it is developed, small increases to 0.2 m would be preferable to any decrease.

### 2.3.2.10 Muriel Lake

In Muriel Lake, most of the lake margin is rather steep, especially along its northern and eastern shores. A lowering of water levels by as much as 1.0 m would reduce the total area of the lake by only about 6%. Increases in lake levels of 0.2 m would have little effect on lake communities, but at higher levels there would be some erosion and tree fall together with elimination of emergent plant communities. C. McGregor feels that shoreline habitats are particularly sensitive to lowering of lake levels, particularly in the shallow eastern portions of the lake, though drops of 0.2 m or less will cause little change in vegetation.

The morphoedaphic index for the lake, 83.0, is the highest recorded for the lakes surveyed in 1981 (Table 6). Catches per unit effort are in the middle range for the lakes surveyed (Tables 3, 4, and 5). The lake would appear to be at least moderately, possibly highly, productive of fish.

Pike, yellow perch, and lake whitefish all occur in abundance, but not yellow walleye. There is a commercial fishery, primarily for lake whitefish, though northern pike and burbot are also taken; and there is a large domestic fishery for both lake whitefish and pike. During an egg survey in the fall of 1981, AEL personnel found that lake whitefish eggs were common at depths of 1.0 to 4.0 m with some as shallow as 0.6 m.

Lakeshore vegetation communities have been described as particularly sensitive to drawdown beyond 0.2 m. Any extensive drawdown would adversely affect the shallow bays on the east and southeast sides of the lake with consequent adverse effects on the pike and yellow perch which occur there. These are especially important because of the relatively small area of warm shallows which occur around the periphery of the lake. In addition, drawdowns could adversely affect the survival of lake whitefish eggs distributed in shallow water should these occur during the winter period of egg incubation.

Lake level increases would probably be less damaging to fish populations than would decreases, but the predicted reductions in the emergent zone and erosion of the lake margin at higher levels could more than balance the increase in wetted area.

Overall, it would appear that communities near shore in this lake are among the most sensitive to water level fluctuations of any of the lakes examined. Minimal water level fluctuations of ±0.2 m would be preferred, especially if they involved increases rather than declines.

### 2.3.2.11 Reita Lake

Reita Lake is relatively shallow with a maximum depth of about 4 m. Under existing conditions, lake levels are very stable, fluctuating only about 0.2 m, the lowest of any of the lakes in the Study Area. There are extensive, lushly vegetated shallows along the southern, eastern, and western shores of the lake which are very susceptible to damage by lake level fluctuations (C. McGregor). Flooding or dessication will likely result in major changes in species composition among the phreatic, emergent, and aquatic flora. Effects on nearshore habitats will be greatest at the highest levels of water level change (1.0 m), but generally negligible at the lowest levels (0.2 m).

Fish populations in Reita Lake have not been assessed, but in recent years there has been a limited commercial fishery for pike. In the absence of further information, we would recommend that if this lake is developed, it be treated like May Lake and managed for pike.

### 2.3.2.12 Tucker Lake

With respect to Tucker Lake, C. McGregor notes that rises in lake levels by 0.2 to 0.5 m would cause some flooding of organic areas. Increases beyond that level would severely increase erosion. Decreases in lake levels by 0.2 m would only slightly limit aquatic macrophyte beds and emergent zones. Lake levels lower than 0.2 m would have an increasingly severe effect. The shallow eastern end of Tucker Lake would appear to be particularly susceptible to water level reductions.

This lake, which has a high morphoedaphic index (Table 6) has a high level of primary production, and, in recent years, has been close to catastrophic winter kill due to low oxygen concentrations (McCart et al. 1979). Catch per unit effort for minnow seines (Table 3) was just below the average for the lakes surveyed in 1981, but beach seine catches were very low (Table 4). No gillnetting was done.

Tucker Lake supports a recreational fishery for perch and pike, both during summer and winter. It would probably be even more popular if access were better. It also supports a commercial fishery, primarily for pike, which is reported to have the highest production per unit area of any comparable fishery in Alberta (McCart et al. 1979). Walleye and lake whitefish have both been reported in the lake in the past (Table 2), but seem to be absent now, possibly due to the increasing productivity and reduced oxygen concentrations.

The major concern with this lake is the possibility that water level manipulation might increase nutrient loadings, leading to increased primary productivity and winter kill. This could occur with both increased and decreased water levels. For this reason, this lake seems to be a poor choice for water level manipulation; however, if water levels are manipulated, it may be possible to mitigate some of the potentially adverse effects by pumping air into the lake during the first few winters when increased nutrient loadings will have their greatest effect.

If levels are manipulated, decreases to 0.2 m might be tolerable--the loss of perimeter shoreline might be balanced to a considerable extent by the appearance of islands with their own shorelines. Increases would, however, be preferred as they would increase the area available to fish. Increases to 0.5 m seem acceptable, but above this level, erosion becomes a serious problem. If the lake is developed for water management, considerations should be given to providing a seasonality of water level fluctuations beneficial to pike as has been described previously in Section 2.3.1.4.

### 2.3.2.13 Wolf Lake

McGregor's predictions of changes in shoreline habitats at Wolf Lake indicate that even the smallest decrease in water levels (0.2 m) would have generally adverse effects on the lakeshore habitats favoured by fish (reducing, for example, the area occupied by emergent vegetation). An equivalent increase, in contrast, though increasing the area of eroding shoreline, has considerably less effect on favoured habitats. A similar relationship holds at the intermediate (0.5 m) and highest (1.0 m) scenarios for water level changes—decreases appear to be more damaging than equivalent increases.

The lake has extensive shallows and an examination of area/capacity curves indicates the area of the lake would be reduced by approximately 8.7%, 12.8%, and 22.4% with, respectively, 0.2, 0.5 and 1.0 m decreases in mean water levels. The comparable estimates can be made for increases in mean water levels, but the extensive low relief around the lake and the shallow sills separating Lane Lake and Corner Lake from Wolf Lake proper suggest that even small increases in elevation might markedly increase the availability of nearshore habitat. Increases in water levels by 0.5 m might be beneficial in providing a greater area of nearshore habitat and a greater absolute production of fish without serious damage to optimal fish habitats. A 1.0 m increase in water levels would also increase the area of nearshore habitat, but the higher incidence of erosion and other disturbance may counteract increases in production based on increased area alone.

The morphoedaphic index of 23.2 (Table 6) suggests that Wolf Lake should be moderately productive of fish. Catches per unit effort for seines and gillnets are all in the intermediate range for lakes included in the 1981 survey. The nearshore fish fauna is dominated by yellow perch and northern pike among the economic species, lake whitefish and yellow walleye occurring in appreciable numbers only in gillnet catches (Tables 3, 4, and 5). Spottail shiners, white suckers, and Iowa darter dominate the non-economic species. Lake cisco were rarely taken during netting operations, but lake cisco eggs were sampled in October 1981 (Aquatic Environments Limited, file data). The eggs were found over a depth range of 0.3 to 3.5 m, the latter the maximum sampling depth. Typically, the substrate in the areas where eggs were recovered was mud and silt with some vegetation cover.

There is an annual commercial fishery on the lake which takes varying proportions of four species—lake whitefish, lake cisco, northern pike, and yellow walleye. There is a provincial park at the lake and it is popular with anglers and its fishermen.

Overall, those scenarios which call for decreased water levels would seem to be potentially more damaging than those which will result in increases. Conservatively, the scenarios involving increases of 0.2 m and 0.5 m should be favoured over any of the others, particularly if water levels in the spring are manipulated to optimize spawning conditions for northern pike, walleye, and yellow perch.

## 3.0 STREAMS

### 3.1 Distribution of Species

Table 7 lists those species which have been reported from the streams included in the 1981 field surveys. As previously indicated (Section 2.1), one species (the river shiner) has been only tentatively identified.

The largest streams included in the study (The Beaver and Sand rivers and Jackfish Creek) have the largest complement of species (Table 7). This reflects the fact that larger waterbodies presumably provide a greater array of niches, but also the fact that many of the smaller streams (including Manatokan, Marie, Muriel, and Reita creeks and the Mooselake River) were intermittent or dry during the 1981 field season. In wetter years, they may support a wider array of species.

The northern pike was the most widely distributed species occurring in all 10 streams in the survey. The yellow perch was another economic species which was common, taken at six localities. The yellow walleye was taken in only three locations including the two largest streams, the Sand and Beaver rivers, and in the Mooselake River. The most widely distributed non-economic species were the white sucker (eight locations) and the spottail shiner (five locations).

## 3.2 Relative Abundance of Species

Minnow seine catches (Table 8) indicate considerable variability in relative abundance among streams. Where they occur, such species as spottail shiner, young-of-the-year suckers (longnose and white combined), brook stickleback, yellow perch, and Iowa darter may constitute a very large proportion of the total catches at individual localities. Economic species, such as the northern pike, yellow perch, and yellow walleye, occur in minnow seine catches only occasionally, and, except for the predominance of yellow perch in the small catches in the Thinlake River, in relatively low numbers.

Gillnets, which are selective for the larger species, present a different picture (Table 9). Northern pike, which were captured at each of the gillnet stations, predominate almost everywhere. White suckers, which are more widely distributed and relatively more abundant than the longnose sucker, are second in abundance only to the northern pike. Yellow perch and yellow walleye have a more scattered distribution, but are common locally.

The impression one gets from these data is that, while representatives of the larger life history stages of northern pike, yellow perch, and walleye (those susceptible to capture by gillnet) may occur in streams, the spawning and early rearing of these species (including life history stages susceptible to minnow seining) takes place elsewhere, probably in association with lakes. The only spawning actually observed in streams in 1981 was that of white and longnose suckers in the Sand River downstream of its confluence with Wolf Lake. Other evidence of spawning by suckers was the presence of numerous fry in the Beaver River, upstream of its confluence with the Sand River.

In the smaller streams, likely to freeze to the bottom during the winter, it is likely that most of those fish present during the open water season have entered them to feed during the summer and will return to nearby lakes to overwinter. The same may be true of many fish in the larger streams. Some may be on spawning migrations, moving from lakes and deep pools in the larger streams to traditional spawning areas. It has been suggested, for example, that walleye in the Beaver and Sand rivers migrate in the spring to spawning areas somewhere upstream. If so, one could expect a peak in gillnet catches in the spring during the upstream migration followed by a second, possibly broader peak, later as fish move downstream to overwintering areas. In fact, in 1981, catches in both streams were lowest in spring and highest in fall. Possibly, the upstream migration peaked before field studies began in late April and the higher catches in the fall reflect a downstream movement to overwintering areas.

## 4.0 LITERATURE CITED

Anonymous. 1976. Commercial fisheries catch statistics for Alberta. Fish and Wildlife Division, Alberta Department of Recreation of Fish and Wildlife, Edmonton. 211 pp.

Cross, P. M. 1979. Limnological and fisheries surveys of the aquatic ecosystems at Esso Resources' Cold Lake Lease. Data Volume. Report to Esso Resources Ltd. prepared by Aquatic Environments Limited, Calgary. 550 pp.

Ferrari, D., B. Corbett, and J. McCart. 1982. Detailed data report--fisheries surveys, Cold Lake-Beaver River Study Area. Report to Alberta Environment Planning Division prepared by Aquatic Environments Limited, Calgary.

McCart, P., P. M. Cross, R. Green, D. Mayhood. 1979. Limnological and fisheries surveys of the aquatic ecosystems on Esso Resources' Cold Lake Lease. Report to Esso Resources Ltd. prepared by Aquatic Environments Limited, Calgary. 267 pp.

Machniak, Kazimierz. 1975a. The effects of hydroelectric development on the biology of northern fishes (reproduction and population dynamics) I. Lake Whitefish Coregonus clupeaformis (Mitchill). A literature review and bibliography. Fisheries and Marine Service. Research and Development Technical Report No. 527. 67 pp.

Machniak, Kazimierz. 1975b. The effects of hydroelectric development on the biology of northern fishes (reproduction and population dynamics) II. Northern Pike Esox lucius (Linnaeus). A literature review and bibliography. Fisheries and Marine Service. Research and Development Technical Report No. 528. 28 pp.

Machniak, Kazimierz. 1975c. The effects of hydroelectric development on the biology of northern fishes (reproduction and population dynamics) III. Yellow Walleye Stizostedion vitreum vitreum (Mitchill). A literature review and bibliography. Fisheries and Marine Service. Research and Development Technical Report No. 529. 68 pp.

Ryder, R. A., S. R. Kerr, K. H. Loftus, and H. A. Regier. 1974. The morphoedaphic index, a fish yield estimator--review and evaluation. Journal of the Fisheries Research Board of Canada 31:663-668.

Scott, W. B. and E. J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada. Bulletin 184. 966 pp.

Table 1 List of fish species encountered during field studies in Cold Lake Study Area, 1981, including common and scientific names and four letter codes.

| Common Name | Scientific Name | Code |
|---|---|---|
| Lake whitefish | Coregonus clupeaformis | LKWT |
| Lake cisco | Coregonus artedii | LKCS |
| Northern pike | Esox lucius | PIKE |
| Lake chub | Couesius plumbeus | LKCB |
| Emerald shiner | Notropis atherinoides | EMSH |
| Common shiner | Notropis cornutus | CMSH |
| River shiner? | Notropis blennius | RVSH |
| Spottail shiner | Notropis hudsonius | SPSH |
| Fathead minnow | Pimephales promelas | FHMW |
| Longnose dace | Rhinichthys cataractae | LNDC |
| Pearl dace | Semotilus margarita | PLDC |
| Longnose sucker | Catostomus catostomus | LNSK |
| White sucker | Catostomus commersoni | WTSK |
| Burbot | Lota lota | BURB |
| Brook stickleback | Culaea inconstans | BRST |
| Ninespine stickleback | Pungitius pungitius | NNST |
| Yellow perch | Perca flavescens | YWPH |
| Yellow walleye | Stizostedion vitreum | WALL |
| Iowa darter | Etheostoma exile | IODR |
| Logperch | Percina caprodes | LGPH |
| Slimy sculpin | Cottus cognatus | SLSC |

Table 2 Distribution of fish species among lakes in Cold Lake Study Area. Single cross indicates fish species taken during 1981 field studies, double cross indicates data from other sources. CF indicates commercial fishery.

| Species | Angling Lake | Burnt Lake CF | Caribou Lake | *Cold Lake CF | Ethel Lake CF | Manatokan Lake | Marie Lake CF | Moose Lake CF | Muriel Lake CF | Tucker Lake CF | Wolf Lake CF | Total Locations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake whitefish |  | + |  | + | ++ |  | ++ | ++ | + | ++ | + | 8 |
| Lake cisco |  | ++ |  | ++ | ++ |  | ++ | + |  |  | ++ | 6 |
| Northern pike | + | + | + | + | + | + | ++ | + | + | + | + | 11 |
| Lake chub |  |  |  | ++ |  |  | ++ | + | + |  |  | 4 |
| Emerald shiner |  |  |  |  |  |  |  |  |  |  |  | 0 |
| River shiner? |  |  |  |  |  |  |  |  |  |  |  | 0 |
| Spottail shiner | + | + |  | ++ | + |  | + | + | + |  | + | 8 |
| Fathead minnow |  |  |  |  |  |  | ++ |  |  |  |  | 1 |
| Longnose dace |  |  |  |  |  |  |  |  |  |  |  | 0 |
| Pearl dace |  |  |  |  |  |  |  |  |  |  |  | 0 |
| Longnose sucker |  |  | ++ |  | ++ |  | ++ |  |  |  | ++ | 4 |
| White sucker | ++ | + | + | + | + | + | + |  | ++ | + | + | 10 |
| Burbot | + | ++ |  |  | ++ |  | + | + | + | + | + | 8 |
| Brook stickleback |  |  |  | ++ | ++ | + |  | + | + | + | + | 7 |
| Ninespine stickleback |  |  |  | ++ | + | + | + | + |  | + | + | 7 |
| Yellow perch | + | + |  | + | + | + | + | + | + | + | + | 10 |
| Yellow walleye |  | + |  | + | ++ |  | ++ | + | ++ | ++ | + | 8 |
| Iowa darter |  |  |  | ++ | + |  | + | + | + | + | + | 7 |
| Logperch |  |  |  |  |  |  | + |  |  |  |  | 1 |
| Slimy sculpin |  |  |  | + |  |  |  |  |  |  |  | 1 |
| Total species | 5 | 8 | 3 | 12 | 12 | 5 | 14 | 11 | 10 | 9 | 12 |  |

*Data for Long Bay, Centre Bay & French Bay only

Table 3 Summary of minnow seine catches in lakes in Cold Lake Study Area, 1981.

| | Angling Lake | Cold* Lake | Ethel Lake | Manatokan Lake | Marie Lake | Moose Lake | Muriel Lake | Tucker Lake | Wolf Lake | Means |
|---|---|---|---|---|---|---|---|---|---|---|
| Effort ($m^2$) | 1083 | 368 | 2677 | 2900 | 3186 | 5023 | 3666 | 2757 | 4983 | 2960 |
| CPUE** ($n/m^2$) | 3.97 | 0.36 | 1.44 | 0.50 | 0.05 | 1.45 | 1.11 | 1.04 | 0.85 | 1.20 |
| Species (%) | | | | | | | | | | |
| Lake whitefish | | | | | | | | | | 0.0 |
| Lake cisco | | | | | | | | | | 0.0 |
| Northern pike | 8.3 | | 0.1 | <0.1 | | 0.2 | | 12.1 | 57.5 | 8.7 |
| Lake chub | | | | | | | 0.2 | | | <0.1 |
| Emerald shiner | | | | | | | | | | 0.0 |
| River shiner? | | | | | | | | | | 0.0 |
| Spottail shiner | 49.9 | 34.8 | 42.3 | | 37.7 | 73.9 | 89.2 | | | 36.4 |
| Fathead minnow | | 56.8 | | | | | | | | 6.3 |
| Longnose dace | | | | | | | | | | 0.0 |
| Pearl dace | | | | | | | | | | 0.0 |
| Longnose sucker | | | | | | | | | | 0.0 |
| White sucker | | | 3.1 | 0.1 | 2.1 | | | | 13.4 | 2.1 |
| Burbot | 4.2 | | | | 3.0 | | <0.1 | | 0.5 | 0.9 |
| Brook stickleback | | | | 33.5 | | 0.6 | 0.7 | 3.2 | 1.1 | 4.3 |
| Ninespine stickleback | | 0.8 | 0.8 | 33.3 | 1.9 | 0.3 | | 0.1 | 0.1 | 4.2 |
| Yellow perch | 37.6 | | 21.6 | 33.1 | 18.1 | 18.6 | 3.0 | 47.3 | 15.5 | 21.6 |
| Yellow walleye | | | | | | | | | | 0.0 |
| Iowa darter | | 6.8 | 32.0 | | 36.5 | 6.4 | 6.9 | 37.4 | 11.7 | 15.3 |
| Logperch | | | | | 0.8 | | | | | 0.1 |
| Slimy sculpin | | 0.8 | | | | | | | | 0.1 |

*Combined for Long Bay, Centre Bay and French Bay
**Catch-per-unit-effort.

Table 4 Summary of beach seine catches in lakes in the Cold Lake Study Area, 1981.

|  | Angling Lake | Ethel Lake | Manatokan Lake | Marie Lake | Moose Lake | Muriel Lake | Tucker Lake | Wolf Lake | Means |
|---|---|---|---|---|---|---|---|---|---|
| Effort (m²) | 6127 | 9189 | 10415 | 6742 | 17765 | 11639 | 6433 | 17766 | 10760 |
| CPUE* (n/m²) | 0.02 | 0.48 | 0.30 | 0.06 | 0.55 | 0.12 | 0.01 | 0.34 | 0.23 |
| Species |  |  |  |  |  |  |  |  |  |
| Lake Whitefish |  |  |  |  |  | 1.7 |  |  | 0.2 |
| Lake cisco |  |  |  |  | 6.3 |  |  |  | 0.8 |
| Northern pike | 50.5 | 0.3 | 0.9 |  | 0.1 | 0.3 | 30.8 | 0.1 | 10.4 |
| Lake chub |  |  |  |  | 0.1 | 0.8 |  |  | 0.1 |
| Emerald shiner |  |  |  |  |  |  |  |  | 0.0 |
| River shiner? |  |  |  |  |  |  |  |  | 0.0 |
| Spottail shiner | 18.7 | 32.2 |  | 2.1 | 23.4 | 48.5 |  | 14.9 | 17.5 |
| Fathead minnow |  |  |  |  |  |  |  |  | 0.0 |
| Longnose dace |  |  |  |  |  |  |  |  | 0.0 |
| Pearl dace |  |  |  |  |  |  |  |  | 0.0 |
| Longnose sucker |  |  |  |  |  |  |  |  | 0.0 |
| White sucker |  | 7.8 | 0.2 | 32.6 |  |  | 3.2 | 3.2 | 5.9 |
| Burbot |  |  |  |  | 0.3 | 0.1 | 5.5 | 0.1 | 0.7 |
| Brook stickleback |  |  | 3.7 |  | 2.2 | 0.9 | 1.7 | 0.1 | 1.1 |
| Ninespine stickleback |  |  |  | 0.2 | 2.9 |  |  | 0.1 | 0.4 |
| Yellow perch | 30.8 | 58.5 | 95.2 | 61.7 | 52.0 | 30.2 | 54.0 | 79.5 | 57.6 |
| Yellow walleye |  |  |  |  | 10.5 |  |  | <0.1 | 1.3 |
| Iowa darter |  | 1.3 |  | 3.1 | 2.5 | 17.6 | 5.2 | 2.0 | 4.0 |
| Logperch |  |  |  | 0.2 |  |  |  |  | <0.1 |
| Slimy sculpin |  |  |  |  |  |  |  |  | 0.0 |

*Catch-per-unit-effort

Table 5 Summary of gillnet catches in lakes in the Cold Lake Study Area, 1981.

| | Lakes | | | | | | |
|---|---|---|---|---|---|---|---|
| | Angling | Burnt | Caribou | Cold* | Muriel | Wolf | Means |
| Effort (hr) | 4.5 | 134 | 148 | 736 | 47 | 64 | 189 |
| CPUE** (N/hr) | 3.78 | 0.93 | 0.35 | 0.69 | 0.28 | 0.75 | 1.13 |
| Species (%) | | | | | | | |
| Lake Whitefish | | 1.5 | | 1.6 | 53.9 | 5.0 | 10.3 |
| Lake cisco | | | | | | | 0.0 |
| Northern pike | 41.2 | 13.4 | 86.5 | 66.4 | 46.1 | 50.6 | 50.7 |
| Lake chub | | | | | | | 0.0 |
| Emerald shiner | | | | | | | 0.0 |
| River shiner? | | | | | | | 0.0 |
| Spottail shiner | | 48.5 | | | | | 8.1 |
| Fathead minnow | | | | | | | 0.0 |
| Longnose dace | | | | | | | 0.0 |
| Pearl dace | | | | | | | 0.0 |
| Longnose sucker | | | | | | | 0.0 |
| White sucker | | 0.7 | 13.5 | 6.4 | | 22.1 | 7.1 |
| Burbot | | | | | | | 0.0 |
| Brook stickleback | | | | | | | 0.0 |
| Ninespine stickleback | | | | | | 2.7 | 0.5 |
| Yellow perch | 58.8 | 17.9 | | 22.2 | | 14.9 | 19.0 |
| Yellow walleye | | 17.9 | | 3.4 | | 4.8 | 4.3 |
| Iowa darter | | | | | | | 0.0 |
| Logperch | | | | | | | 0.0 |
| Slimy sculpin | | | | | | | 0.0 |

*Combined for Long Bay, Centre Bay and French Bay

**Catch-per-unit-effort

Table 6 Area, mean depth, total dissolved solids concentration (TDS) and morphoedaphic index (MEI) for lakes in the Cold Lake Study Area.

| Lake | Surface Area (km²) | Mean Depth (m) | TDS (ppm) | MEI |
|---|---|---|---|---|
| Angling | 5.85 | 5.5 | - | - |
| Burnt | 4.43 | 3.7 | - | - |
| Caribou | 4.45 | 0.9 | - | - |
| Cold | 373.0 | 59.7 | 185 | 3.1 |
| Ethel | 4.83 | 6.6 | 173 | 26.2 |
| Manatokan | 4.14 | - | - | - |
| Marie | 36.2 | 14.1 | 140 | 9.9 |
| May | 3.0 | 5.6 | 138 | 24.6 |
| Moose | 38.6 | 5.3 | 374 | 70.6 |
| Muriel | 63.3 | 6.6 | 550 | 83.0 |
| Reita | 12.5 | 2.5 | - | - |
| Tucker | 7.2 | 2.9 | 204 | 70.3 |
| Wolf | 30.7 | 8.2 | 190 | 23.2 |

Table 7 Distribution of fish species among streams in the Cold Lake Study Area. Single cross indicates fish species taken during 1981 field studies, double cross indicates data from other sources.

| Species | Beaver River | Jack-fish Creek | Mana-tokan Creek | Marie Creek | Moose-lake River | Muriel Creek | Reita River | Sand River | Thin-Lake River | Wolf River | Total Locations |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake whitefish | + | | | | | | | | | | 1 |
| Lake cisco | | | | | | | | | | | 0 |
| Northern pike | + | + | + | + | + | + | + | + | + | + | 10 |
| Lake chub | + | + | | | | | | | | | 2 |
| Emerald shiner | + | | | | | | | + | | | 2 |
| River shiner? | | + | | | | | | + | | | 2 |
| Spottail shiner | | | | ++ | | + | + | + | + | | 5 |
| Fathead minnow | + | | | | | | | + | | | 2 |
| Longnose dace | | | | | | | | + | | | 1 |
| Pearl dace | + | + | | | | | | + | | | 3 |
| Longnose sucker | + | + | | | | | | + | | | 3 |
| White sucker | + | + | + | + | + | | | + | + | + | 8 |
| Burbot | | | | | | | | | | | 0 |
| Brook stickleback | + | + | | | | | | + | + | | 4 |
| Ninespine stickleback | | + | | | | | | | | | 1 |
| Yellow perch | + | + | + | ++ | + | | | | + | | 6 |
| Yellow walleye | + | | | | + | | | + | | | 3 |
| Iowa darter | | + | | | | | | + | | | 2 |
| Logperch | | | | | | | | | | | 0 |
| Slimy sculpin | | | | | | | | | | | 0 |
| Total species | 11 | 10 | 3 | 4 | 4 | 2 | 2 | 12 | 5 | 2 | |

Table 8 Summary of minnow seine catches in streams in the Cold Lake Study Area, 1981.

| | Beaver River | Jackfish Creek | Manatokan Creek | Marie Creek | Mooselake River | Reita River | Sand River | Thinlake River | Means |
|---|---|---|---|---|---|---|---|---|---|
| Effort ($m^2$) | 1879 | 980 | 858 | 245 | 122 | 441 | 3961 | 857 | 1168 |
| CPUE* ($n/m^2$) | 0.92 | 0.47 | <0.01 | 0.03 | 0.0 | <0.01 | 1.22 | 0.02 | 0.33 |
| Species (%) | | | | | | | | | |
| Lake whitefish | | | | | | | | | 0.0 |
| Lake cisco | | | | | | | | | 0.0 |
| Northern pike | | 0.3 | | | | | 1.9 | | 0.3 |
| Lake chub | 0.5 | 0.3 | | | | | | | 0.1 |
| Emerald shiner | 0.1 | | | | | | <0.1 | | <0.1 |
| River shiner? | | 0.3 | | | | | 0.6 | | 0.1 |
| Spottail shiner | | | | | | 100.0 | 0.3 | 40.4 | 20.1 |
| Fathead minnow | 2.3 | | | | | | 1.9 | | 0.6 |
| Longnose dace | | | | | | | 0.1 | | <0.1 |
| Pearl dace | 3.0 | 8.2 | | | | | 11.5 | | 3.2 |
| Longnose sucker } | 80.4 | 20.9 | | 14.3 | | | 81.9 | | 28.2 |
| White sucker | | | | | | | | | |
| Burbot | | | | | | | | | 0.0 |
| Brook stickleback | 13.9 | 62.9 | 100.0 | | | | <0.1 | 4.6 | 25.9 |
| Ninespine stickleback | | | | | | | | | 0.0 |
| Yellow perch | | 0.3 | | | | | | 55.0 | 7.9 |
| Yellow walleye | | | | | | | 1.9 | | 0.3 |
| Iowa darter | | 6.9 | | 85.7 | | | 0.3 | | 13.3 |
| Logperch | | | | | | | | | 0.0 |
| Slimy sculpin | | | | | | | | | 0.0 |

*Catch-per-unit-effort

Table 9 Summary of gillnet catches in streams in the Cold Lake Study Area, 1981.

| | Streams | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Beaver River | Jackfish Creek | Manatokan Creek | Marie Creek | Mooselake River | Reita Creek | Sand River | ThinLake River | Wolf River | Means |
| Effort (hr) | 614 | 166 | 40 | 109 | 122 | 21 | 633 | 91 | 24 | 202 |
| CPUE* (N/hr) | 0.34 | 0.64 | 0.45 | 0.38 | 1.25 | 0.24 | 0.22 | 1.15 | 0.67 | 0.59 |
| Species (%) | | | | | | | | | | |
| Lake Whitefish | 1.3 | | | | | | | | | 0.1 |
| Lake cisco | | | | | | | | | | 0.0 |
| Northern pike | 10.9 | 47.6 | 72.0 | 72.5 | 50.9 | 100.0 | 28.1 | 42.1 | 93.7 | 57.5 |
| Lake chub | | | | | | | | | | 0.0 |
| Emerald shiner | | | | | | | | | | 0.0 |
| River shiner? | | | | | | | | | | 0.0 |
| Spottail shiner | | | | | | | | | | 0.0 |
| Fathead minnow | | | | | | | | | | 0.0 |
| Longnose dace | | | | | | | | | | 0.0 |
| Pearl dace | | | | | | | | | | 0.0 |
| Longnose sucker | 8.1 | 3.0 | | | | | 26.9 | | | 4.2 |
| White sucker | 59.1 | 38.9 | 17.0 | 27.5 | 26.8 | | 40.1 | 12.7 | 6.3 | 25.4 |
| Burbot | | | | | | | | | | 0.0 |
| Brook stickleback | | | | | | | | | | 0.0 |
| Ninespine stickleback | | 10.4 | | | | | | | | 1.1 |
| Yellow perch | 0.6 | | 11.0 | | 20.3 | | | 81.6 | | 12.6 |
| Yellow walleye | 19.9 | | | | 2.0 | | 5.0 | | | 3.0 |
| Iowa darter | | | | | | | | | | 0.0 |
| Logperch | | | | | | | | | | 0.0 |
| Slimy sculpin | | | | | | | | | | 0.0 |

*Catch-per-unit-effort

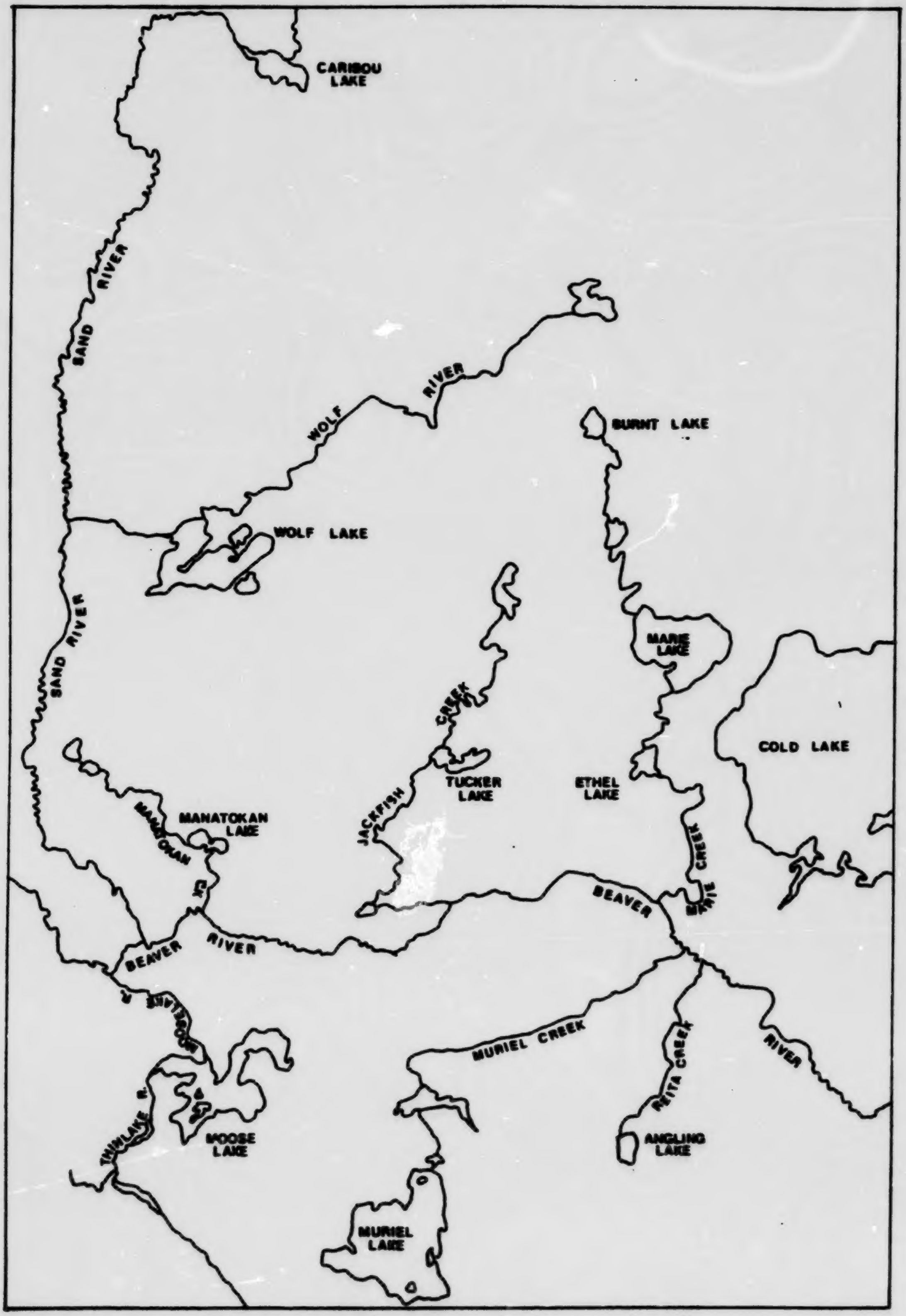

CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN CR.
MARIE CREEK
BEAVER
BEAVER RIVER
MOOSELAKE R.
THINLAKE R.
MOOSE LAKE
MURIEL CREEK
REITA CREEK
RIVER
ANGLING LAKE
MURIEL LAKE
0 5 10 20 MILES
0 5 10 20 KM

Figure 1 Map of the Study Area showing locations of lakes and streams

## APPENDIX G

# FISHERIES STUDIES; DETAILED DATA REPORT

A Report Prepared By
AQUATIC ENVIRONMENTS LTD.

**AQUATIC
ENVIRONMENTS
LIMITED**

*biological consultants*

9 December 1983

Alberta Environment
Planning Division
9th Floor, Oxbridge Place
9820 106 Street
Edmonton, Alberta

Attention: Ron Hicks

Dear Ron:

We are pleased to submit to you our report entitled "Fisheries Studies Cold Lake-Beaver River Study Area - Volume II Detailed Data Report".

If you have any questions regarding this report, please feel free to contact me at our Calgary office (403-276-8171).

Sincerely,

AQUATIC ENVIRONMENTS LIMITED

Peter McCart, PhD
President

PM/ksd
Encl.

1235A - 40th Avenue N.E., Calgary, Alberta T2E 6M9 Phone (403) 276-8171

# 1.0 INTRODUCTION

This volume, Volume II of a report entitled Fisheries Studies, Cold Lake-Beaver River Study Area, is a presentation of detailed fisheries survey data gathered from 11 lakes and 10 streams (Table 1 and Figure 1). It includes both site-specific information and data summaries on fish species captured in the Study Area (Table 2). These materials are arranged as a lake and stream catalogue. Data for lakes are presented first and those for streams, second. Within each group, waterbodies are listed alphabetically.

# 2.0 METHODS

## 2.1 Sampling Periods

Fish in lakes and streams in the Study Area were sampled during three periods in the open water season of 1981:

| | |
|---|---|
| Spring | April 22 to May 27 |
| Summer | July 8 to July 23 |
| Fall | October 1 to October 14 |

## 2.2 Sampling Procedures

### 2.2.1 Lakes

Fish sampling in lakes was confined to nearshore, shallow water areas. In each lake, sampling sites were chosen to be representative of the major communities of aquatic and emergent vegetation and of unvegetated (sand, gravel, and rock) zones. The location of each sampling site was recorded on a map so it could be relocated on subsequent visits, and the site described in terms of depth, shoreline features, aquatic and emergent vegetation, and substrate. Water temperatures were recorded with a pocket thermometer held just under the water surface.

Fish were captured using seines, gillnets, and Gee minnow traps. Two types of seine were used—a 6.0 m long, 1.5 m deep, pole-mounted minnow seine of fine mesh (0.4 cm) nylon marquisette, and a 30.5 m long, 2.0 m deep beach seine with 3.8 cm mesh wings and a 1.9 cm mesh pocket. At each sampling site, on each sampling occasion, three hauls approximately 10 m in length were made with the minnow seine and one haul 30 m in length with the beach seine. All hauls were made parallel to shore.

Where seines could not be used (because of the presence of coarse substrates, snags, windfalls, etc.) gillnets (18.3 m long and 2.4 m deep, consisting of six equal panels of monofilament nylon 3.8, 5.1, 6.4, 7.5, 8.9, and 10.2 cm stretch mesh) and Gee minnow traps (baited with salted salmon roe) were used. In both instances, records were kept of the duration of sets. Gee minoow traps proved generally unsatisfactory, taking few fish, and were not extensively used.

During the spring sampling period, recently hatched perch and walleye fry were sampled in Wolf, Moose, and Cold lakes (specifically French, Centre, and Long bays) by means of tow nets. The tow nets were two standard drift nets (each 45.5 cm wide and 30.5 cm deep) mounted on an angle iron frame on either side of the bow of a small aluminum boat. Early in the study, a standard throttle setting was established which seemed to provide optimum fishing conditions and all subsequent sampling was done at that engine speed. All tows were a standard three minutes in duration.

Most captured fish were identified to species, counted, measured, and released. In some instances (i.e. in seine hauls where large numbers of fish of the same species were captured), only a subsample was measured. The subsample was selected by scoop from fish bagged in the bunt of the net.

### 2.2.2 Streams

Sampling sites in streams were chosen to represent a variety of habitat types. As in lakes, emphasis was on shallow, nearshore habitats. At each sampling site, records were made of bank features, the characteristics of any aquatic vegetation present, and substrate type. Water temperatures were recorded with a pocket thermometer held just under the water surface.

A variety of techniques was used to capture fish including minnow seines, electofishers, gillnets, baited Gee minnow traps, and drift nets. The minnow seines and gillnets were identical to those described for lake sampling above. Minnow seining consisted of three 10 m hauls parallel to the shore. (Beach seines were not used in streams.) Gillnets were typically set overnight and the duration of the set was recorded. As in lakes, Gee minnow traps proved generally unsatisfactory and were rarely used.

Electrofishing (using a Smith-Root Type V backpack electrofisher) was utilized in those areas not suited to seining. Distance and total time shocked (in seconds) were recorded for each sampling site.

Drift nets (or "bombs"), measuring 30.5 x 30.5 cm were used to sample drifting fry in four streams in the Study Area (the Beaver, Sand, Wolf, and Mooselake rivers). The duration of drift sampling periods varied, but was usually either one hour every four hours over a 24-hour period or an overnight set of approximately 12 hours. Captured fish were identified to species, enumerated, and measured as were samples from lakes.

Table 1 List of Water Bodies Investigated.

**LAKES**

| Lake Number | Lake Name |
|---|---|
| 1 | Angling Lake |
| 2 | Burnt Lake |
| 3 | Caribou Lake |
| 4 | Cold Lake |
| 5 | Ethel Lake |
| 6 | Manatokan Lake |
| 7 | Marie Lake |
| 8 | Moose Lake |
| 9 | Muriel Lake |
| 10 | Tucker Lake |
| 11 | Wolf Lake |

**STREAMS**

| Stream letter | Stream Name |
|---|---|
| A | Beaver River |
| B | Jackfish Creek |
| C | Manatokan Creek, Inflow and Outflow |
| D | Marie Creek |
| E | Mooselake River |
| F | Muriel Creek |
| G | Reita Creek |
| H | Sand River |
| I | Thinlake River |
| J | Wolf River, Inflow and Outflow |

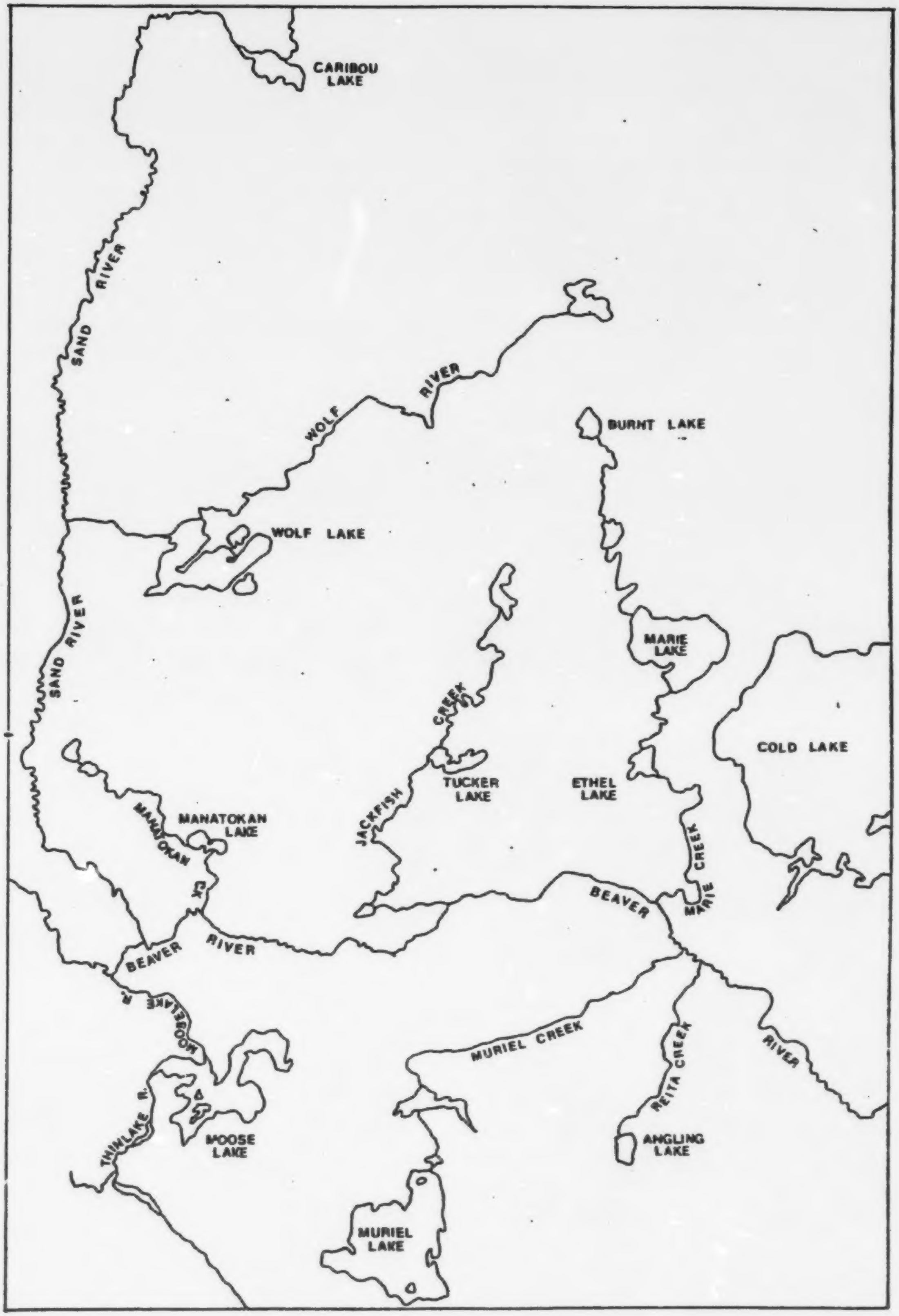

CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN CK
MANATOKAN LAKE
MARIE CREEK
BEAVER RIVER
BEAVER
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE

Figure 1 Map of the Study Area showing locations of lakes and streams

0 5 10 20 MILES
0 5 10 20 KM

Table 2 List of species, by common name, scientific name, and code, for fish found in the Cold Lake Study Area

| Common Name | Scientific Name | Code |
|---|---|---|
| Lake whitefish | *Coregonus clupeaformis* | LKWT |
| Lake cisco | *Coregonus artedii* | LKCS |
| Northern pike | *Esox lucius* | PIKE |
| Lake chub | *Couesius plumbeus* | LKCB |
| Emerald shiner | *Notropis atherinoides* | EMSH |
| River shiner | *Notropis blennius* | RVSH |
| Spottail shiner | *Notropis hudsonius* | SPSH |
| Fathead minnow | *Pimephales promelas* | FHMW |
| Longnose dace | *Rhinichthys cataractae* | LNDC |
| Pearl dace | *Semotilus margarita* | PLDC |
| Longnose sucker | *Catostomus catastomus* | LNSK |
| White sucker | *Catostomus commersoni* | WTSK |
| Unidentified sucker | *Catostomus* spp. | UNSK |
| Burbot | *Lota lota* | BURB |
| Brook stickleback | *Culaea inconstans* | BRST |
| Ninespine stickleback | *Pungitius pungitius* | NSST |
| Yellow perch | *Perca flavescens* | YWPH |
| Yellow walleye | *Stizostedion vitreum* | WALL |
| Iowa darter | *Etheostoma exile* | IODR |
| Logperch | *Percina caprodes* | LGPH |
| Slimy sculpin | *Cottus cognatus* | SLSC |

# 1.0 ANGLING LAKE

Five sampling sites (numbers 1-1 to 1-5) were established on Angling Lake (Figure 1-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Angling Lake are presented in Table 1-1 (catch-per-unit-effort) and Table 1-2 (length frequencies).

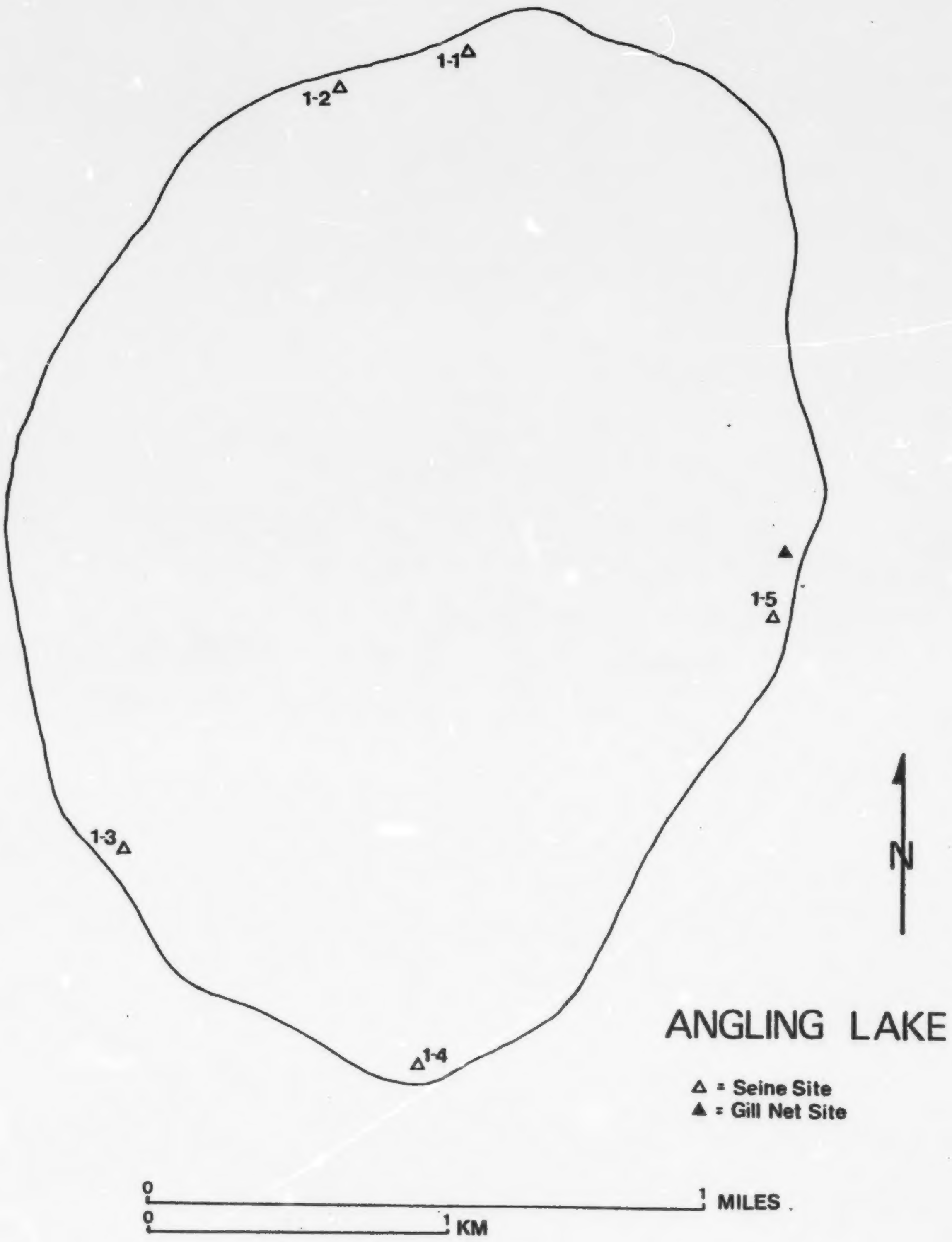

1-1
1-2
1-5
1-3
1-4
N
ANGLING LAKE
△ = Seine Site
▲ = Gill Net Site
0
1 MILES
0
1 KM

Figure 1-1 Map of Angling Lake showing locations of sampling sites.

## LAKE SITE

| | |
|---|---|
| Site Number | 1-1 |
| Lake Name | Angling Lake |
| Location | See Figure 1-1 |

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Very gradual increase in depth from shoreline: 30m-0.75m, 60m-0.75m, 90m-1.0m, 200m-1.5m. |
| Shoreline Features | No true bank or beach. Bulrushes form shoreline. |
| Aquatic Vegetation | Emergent and subemergent. Bulrushes, scouring rush extends 200m from shoreline. Duckweed. |
| Substrate Type | Silt/mud 40%. Sand 60%. |

## SURFACE TEMPERATURE

| Date | May 4 | May 23 | Jul 19 | Oct 12 |
|---|---|---|---|---|
| Temperature | 12°C | 15°C | 23°C | 5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |
| May 23 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |
| Jul 19 | Minnow seine | 1.0m |
| Oct 12 | Minnow seine | 1.0m |

continued

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  | 2.45 |  | 0.82 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 0.41 |  |  | 0.41 |  | 2734.69 |  | 911.56 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 0.82 |  |  | 0.82 | 1.22 |  | 0.82 | 0.68 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2$m^2$ | NS | NS | 1225.2$m^2$ | 245.0$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 163.3 |
| Total Catch | 15 |  |  | 15 | 3 | 3353 | 1 | 1119 |
| Catch/Unit Effort | 0.012/$m^2$ |  |  | 0.012/$m^2$ | 0.012/$m^2$ | 27.371/$m^2$ | 0.008/$m^2$ | 6.852/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number 1-2

Lake Name Angling Lake

Location See Figure 1-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Very gradual increase in depth from shoreline: 30m-0.75m, 60m-0.75m, 90m-1.0m, 200m-1.5m. |
| Shoreline Features | No true bank or beach. Bulrushes form shoreline. |
| Aquatic Vegetation | Emergent and subemergent. Bulrushes, scouring rush extends 200 m from shoreline. Duckweed. |
| Substrate Type | Silt/mud 40%. Sand 60%. |

## SURFACE TEMPERATURE

| | | |
|---|---|---|
| Date | May 4 | May 23 |
| Temperature | 13°C | 15.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |
| May 23 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |

continued

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 0.08 |  |  | 0.08 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 3.84 |  |  | 3.84 |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2$m^2$ | NS | NS | 1225.2$m^2$ | 245.0$m^2$ | NS | NS | 245.0$m^2$ |
| Total Catch | 48 |  |  | 48 | 0 |  |  | 0 |
| Catch/Unit Effort | 0.039/$m^2$ |  |  | 0.039/$m^2$ | 0.00/$m^2$ |  |  | 0.00/$m^2$ |

NS = not sampled

**LAKE SITE**

Site Number 1-3

Lake Name Angling Lake

Location See Figure 1-1

**SITE CHARACTERISTICS**

|  |  |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-0.75m, 60m-1.0m, 90m-3.5m. |
| Shoreline Features | Well defined bank, 3m high. Overhanging trees and bushes. |
| Aquatic Vegetation | Sparse or no submergent vegetation. |
| Substrate Type | Sand 90%. Rubble 10%. |

**SURFACE TEMPERATURE**

| Date | May 4 | May 23 | July 19 | Oct 12 |
|---|---|---|---|---|
| Temperature | 10.5°C | 15.5°C | 23°C | 5°C |

**METHODS**

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |
| May 23 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |
| Jul 19 | Minnow seine | 1.0m |
| Oct 12 | Minnow seine | 1.0m |

continued

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  | 0.82 |  | 0.27 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  | 1326.53 |  | 442.18 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 0.33 |  |  | 0.33 | 3.27 |  | 3.27 | 2.18 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2m$^2$ |  |  | 1225.2m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 4 | NS | NS | 4 | 8 | 1626 | 4 | 546 |
| Catch/Unit Effort | 0.003/m$^2$ |  |  | 0.003/m$^2$ | 0.033/m$^2$ | 13.274/m$^2$ | 0.033/m$^2$ | 3.344/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 1-4

Lake Name Angling Lake

Location See Figure 1-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-0.75m, 60m-0.75m, 90m-1.5m. |
| Shoreline Features | Well defined beach with moderate slope. Poplars and bushes. |
| Aquatic Vegetation | Sparse submergent vegetation. Unattached algal mats. No emergent vegetation. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 4 | May 23 | Jul 19 | Oct 12 |
|---|---|---|---|---|
| Temperature | 13.5°C | 15°C | 23°C | 5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Minnow seine<br>Beach seine | 1.0m<br>0.5m |
| May 23 | Minnow seine<br>Beach seine | 1.0m<br>0.5m |
| Jul 19 | Minnow seine | 1.0m |
| Oct 12 | Minnow seine | 1.0m |

continued

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  | 2538.78 |  | 846.26 |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  | 0.82 | 0.27 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  | 0.82 |  | 0.27 |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2$m^2$ |  |  | 1225.2$m^2$ | 245.0$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 163.3$m^2$ |
| Total Catch | 0 | NS | NS | 0 | 0 | 3111 | 1 | 1037.3 |
| Catch/Unit Effort | 0.00/$m^2$ |  |  | 0.00/$m^2$ | 0.00/$m^2$ | 25.396/$m^2$ | 0.008/$m^2$ | 6.352/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number [illegible]-5
Lake Name Angling Lake
Location See Figure 1-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | gradual to moderate increase in depth from shoreline: 30m-0.75m, 60m-1.0m, 90m-1.5m. |
| Shoreline Features | Narrow beach with moderate slope. Grasses. |
| Aquatic Vegetation | Sparse submergent vegetation. |
| Substrate Type | Sand/silt 100%. |

## SURFACE TEMPERATURE

| Date | May 4 | May 23 | Jul 19 | Oct 12 |
|---|---|---|---|---|
| Temperature | 13°C | 15°C | 23°C | 5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |
| May 23 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |
| Jul 19 | Minnow seine | 1.0m |
| Oct 12 | Minnow seine<br>Beach seine | 1.0m<br>0.75m |

continued

FISH CAPTURES

|  | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| Species | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  | 0.33 | 0.17 |  | 0.82 | 1.63 | 0.82 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 6.04 |  |  | 3.02 |  | 107.76 |  | 35.92 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 1.31 |  |  | 0.66 |  | 25.31 |  | 8.44 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 612.6m$^2$ | NS | 612.6m$^2$ | 612.6m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ |
| Total Catch | 45 |  | 2 | 23.5 | 0 | 164 | 2 | 55.3 |
| Catch/Unit Effort | 0.074/m$^2$ |  | 0.003/m$^2$ | 0.038/m$^2$ | 0.00/m$^2$ | 1.339/m$^2$ | 0.016/m$^2$ | 0.452/m$^2$ |

NS = not sampled

Table 1-1 Summary of catches per effort of fish taken by various methods for Angling Lake, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 1102.7 $m^2$ | | 490.1 $m^2$ | | 490.1 $m^2$ | | 694.3 $m^2$ | |
| Total Catch | 11 | | 8254 | | 8 | | 2754.3 | |
| Catch/Unit Effort | 0.009/$m^2$ | | 16.842/$m^2$ | | 0.016/$m^2$ | | 3.967/$m^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 1.02 | <0.1 | 0.41 | 25.0 | 0.48 | 8.3 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | 1676.67 | 99.6 | 0.82 | 50.0 | 559.16 | 49.9 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | 0.20 | 12.5 | 0.07 | 4.2 |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | 0.99 | 100.0 | 6.53 | 0.4 | 0.20 | 12.5 | 2.57 | 37.6 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 1-1 Continued.

| | Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort<br>Total Catch<br>Catch/Unit Effort | 5513.4m$^2$<br>112<br>0.020/m$^2$ | | N.S. | | 612.6 m$^2$<br>2<br>0.003/m$^2$ | | 3063.0 m$^2$<br>57<br>0.019/m$^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.02 | 1.0 | | | 0.33 | 100.0 | 0.18 | 50.5 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 0.76 | 37.4 | | | | | 0.38 | 18.7 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | 1.25 | 61.6 | | | | | 0.63 | 30.8 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 1-1  Concluded.

| | Gillnet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 4.5 hr | | N.S. | | N.S. | | 4.5 hr | |
| Total Catch | 17 | | | | | | 17 | |
| Catch/Unit Effort | 3.778/hr | | | | | | 3.778/hr | |
| | | | | | | | Means | |
| Species | CPM[2] x100 | % | CPM[2] x100 | % | CPM[2] x100 | % | CPM[2] x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 155.56 | 41.2 | | | | | 155.56 | 41.2 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | 222.22 | 58.8 | | | | | 222.22 | 58.8 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

**Table 1-2** Summary of length-frequency data for fish captured in Angling Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

|  | LKWT |  |  | LKCS |  |  | PIKE |  |  | LKCB |  |  | EMSH |  |  | RVSH |  |  | SPSH |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch |  |  |  |  |  |  | 7 | 3 | 7 |  |  |  |  |  |  |  |  |  | 8 | 10 |  |
| 0-25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 50.0 |  |  |
| 26-50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 50.0 | 80.0 |  |
| 51-75 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 20.0 |  |
| 76-100 |  |  |  |  |  |  | 42.9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 101-125 |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 126-150 |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 151-175 |  |  |  |  |  |  | 28.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 176-200 |  |  |  |  |  |  |  | 66.7 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 201-225 |  |  |  |  |  |  |  | 33.3 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 226-250 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 251-275 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 276-300 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 301-325 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 326-350 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 351-375 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 376-400 |  |  |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |
| 401-425 |  |  |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |
| 426-450 |  |  |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |
| 451-475 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 476-500 |  |  |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |
| 501-525 |  |  |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |
| 526-550 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 551-575 |  |  |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |
| 576-600 |  |  |  |  |  |  |  |  | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |
| 601-625 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 626-650 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 651-675 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 676-700 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 701-625 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 726-750 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 751-775 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 776-800 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 801-825 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Continued.....

Table 1-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | | 1 | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | 100.0 | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued....

Table 1-2 Concluded.

| | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 9 | 30 | 10 | | | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | 55.6 | | | | | | | | | | | | | | | | | |
| 51-75 | | | | 11.1 | 76.7 | | | | | | | | | | | | | | | | |
| 76-100 | | | | 33.3 | 6.7 | | | | | | | | | | | | | | | | |
| 101-125 | | | | | 16.7 | 90.0 | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | 10.0 | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## 2.0 BURNT LAKE

No sampling sites were established on Burnt Lake; however some summer gillnetting was done in this lake (Figure 2-1). Data summaries for Burnt Lake are presented in Table 2-1 (catch-per-unit-effort) and Table 2-2 (length frequencies).

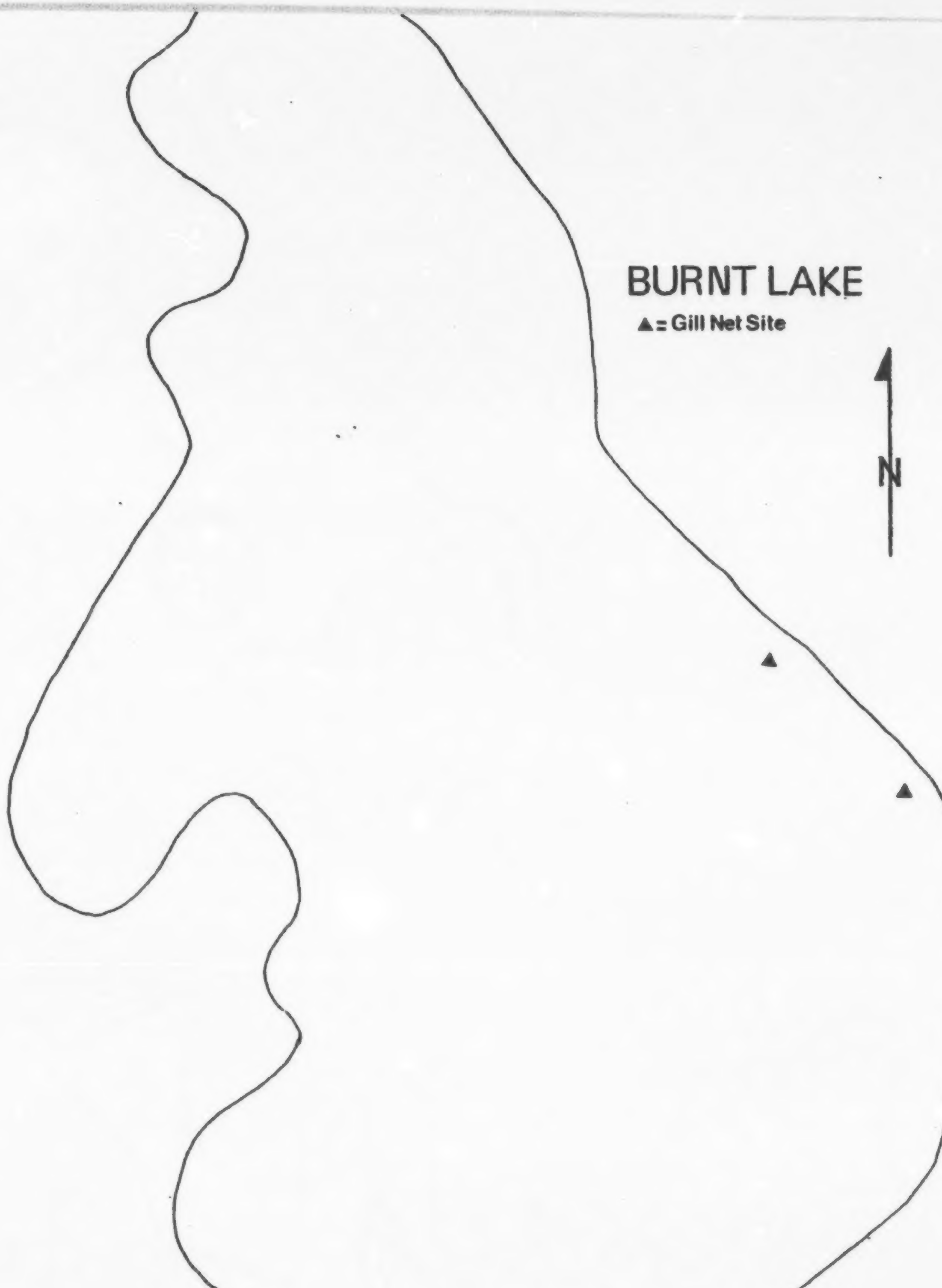

BURNT LAKE
▲ = Gill Net Site
N
0
1 MILES
0
1 KM

Figure 2-1 Map of Burnt Lake showing locations of gillnet sites.

Table 2-1 Summary of catches per unit effort of fish taken by gillnetting, Burnt Lake, 1981. Both catch per unit effort (x 100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Spring | | Summer | | Fall | | Total Mean | |
|---|---|---|---|---|---|---|---|---|
| Effort<br>Total Catch<br>Catch/Unit Effort | N.S. | | 134 hr.<br>144.5<br>0.927/hr | | N.S. | | | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | 1.38 | 1.5 | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 12.46 | 13.4 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | 44.98 | 48.5 | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | 0.69 | 0.7 | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | 16.61 | 17.9 | | | | |
| Yellow walleye | | | 16.61 | 17.9 | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

**Table 2-2** Summary of length-frequency data for fish captured in Burnt Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentage.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | 24 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 6.7 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 13.3 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 13.3 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 20.0 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 13.3 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 20.0 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 6.7 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | 6.7 | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 2-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | 1 | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 100.0 | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 2-2 Concluded.

|  |  | NSST |  |  | YWPH |  |  | WALL |  |  | IODR |  |  | LGPH |  |  | UNSK |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch |  |  |  |  |  | 20 |  |  | 24 |  |  |  |  |  |  |  |  |  |  |  |  |
| 0-25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26-50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 51-75 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 76-100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 101-125 |  |  |  |  |  | 15.0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 126-150 |  |  |  |  |  | 15.0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 151-175 |  |  |  |  |  | 35.0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 176-200 |  |  |  |  |  | 25.0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 201-225 |  |  |  |  |  | 5.0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 226-250 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 251-275 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 276-300 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 301-325 |  |  |  |  |  | 5.0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 326-350 |  |  |  |  |  |  |  |  | 4.2 |  |  |  |  |  |  |  |  |  |  |  |  |
| 351-375 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 376-400 |  |  |  |  |  |  |  |  | 4.2 |  |  |  |  |  |  |  |  |  |  |  |  |
| 401-425 |  |  |  |  |  |  |  |  | 4.2 |  |  |  |  |  |  |  |  |  |  |  |  |
| 426-450 |  |  |  |  |  |  |  |  | 16.7 |  |  |  |  |  |  |  |  |  |  |  |  |
| 451-475 |  |  |  |  |  |  |  |  | 12.5 |  |  |  |  |  |  |  |  |  |  |  |  |
| 476-500 |  |  |  |  |  |  |  |  | 29.5 |  |  |  |  |  |  |  |  |  |  |  |  |
| 501-525 |  |  |  |  |  |  |  |  | 12.5 |  |  |  |  |  |  |  |  |  |  |  |  |
| 526-550 |  |  |  |  |  |  |  |  | 12.5 |  |  |  |  |  |  |  |  |  |  |  |  |
| 551-575 |  |  |  |  |  |  |  |  | 4.2 |  |  |  |  |  |  |  |  |  |  |  |  |
| 576-600 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 601-625 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 626-650 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 651-675 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 676-700 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 701-725 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 726-750 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 751-775 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 776-800 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 801-825 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# 3.0 CARIBOU LAKE

No sampling sites were established on Caribou Lake; however some summer gillnetting was done (Figure 3-1). Data summaries for Caribou Lake are presented in Table 3-1 (catch-per-unit-effort) and Table 3-2 (length frequencies).

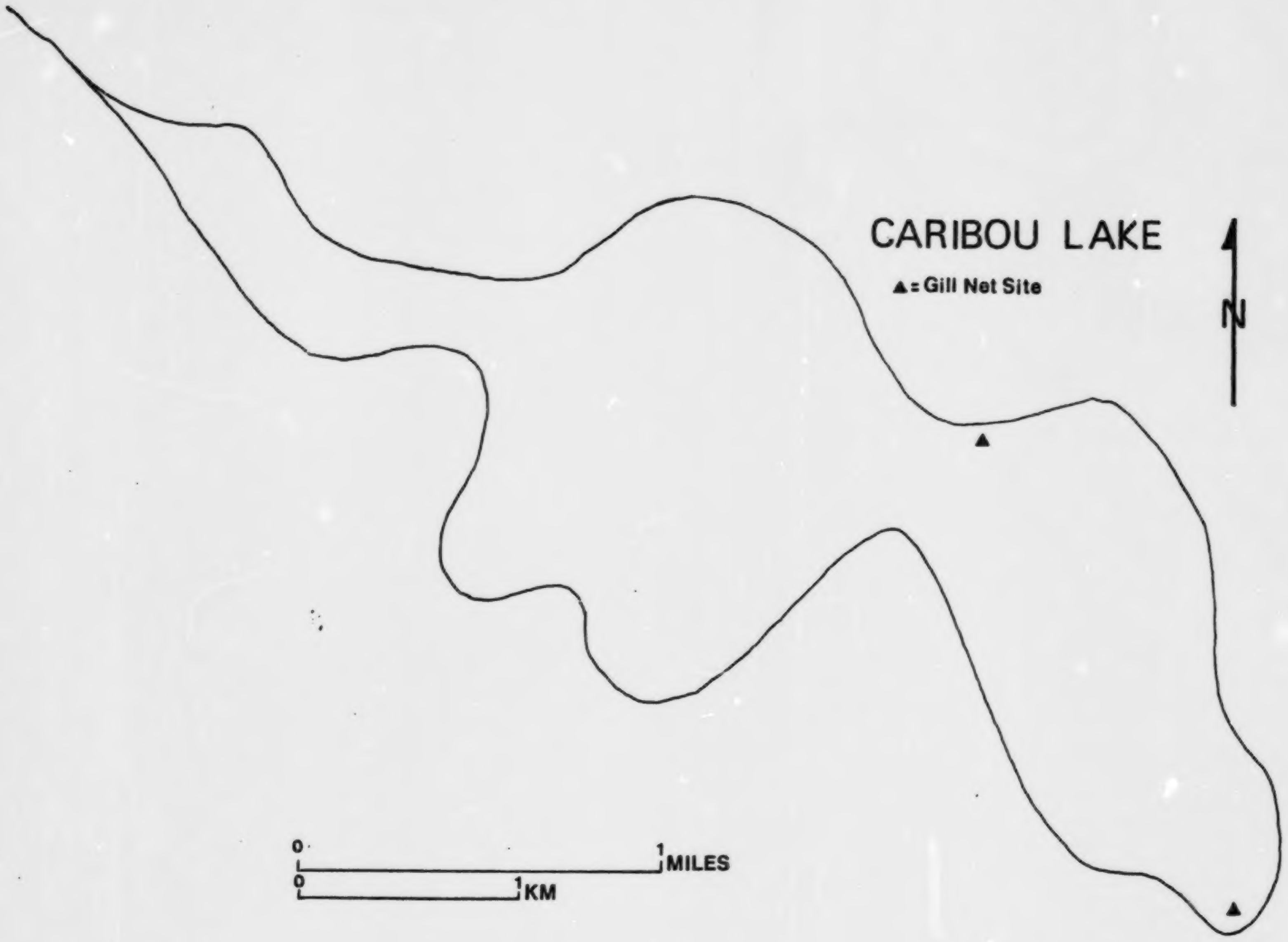

CARIBOU LAKE
▲= Gill Net Site
N
0
1 MILES
0
1 KM

Figure 3-1 Map of Caribou Lake showing locations of gillnet sites.

Table 3-1 Summary of catches per unit effort of fish taken by gillnetting, Caribou Lake, 1981. Both catch per unit effort (x 100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Spring | | Summer | | Fall | | Total Mean | |
|---|---|---|---|---|---|---|---|---|
| Effort | | | 148.0 hr. | | | | | |
| Total Catch | N.S. | | 52 | | N.S. | | | |
| Catch/Unit Effort | | | 0.351/hr. | | | | | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 30.41 | 86.5 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | 4.73 | 13.5 | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 3-2 Summary of length-frequency data for fish captured in Caribou Lake, 1981. Total catch represents number captured; length-frequencies are expressed in percentage.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | 15 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | 33.3 | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 6.7 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 6.7 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 6.7 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 13.3 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 6.7 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 13.3 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | 13.3 | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 3-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | 1 | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | 100.0 | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 3-2 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

# 4.0 COLD LAKE

Three sampling sites were established on Cold Lake, one in each of Long Bay (Site 4-1), Centre Bay (Site 4-2), and French Bay (Site 4-3). No information on site characteristics was recorded for Cold Lake; however surface water temperatures, methods, and fish catches are presented on the numbered Lake Site sheets and data summaries for each bay are presented in Tables 4-1 to 4-3. Sampling locations and methods used in the vicinity of each are presented on Figure 4-1.

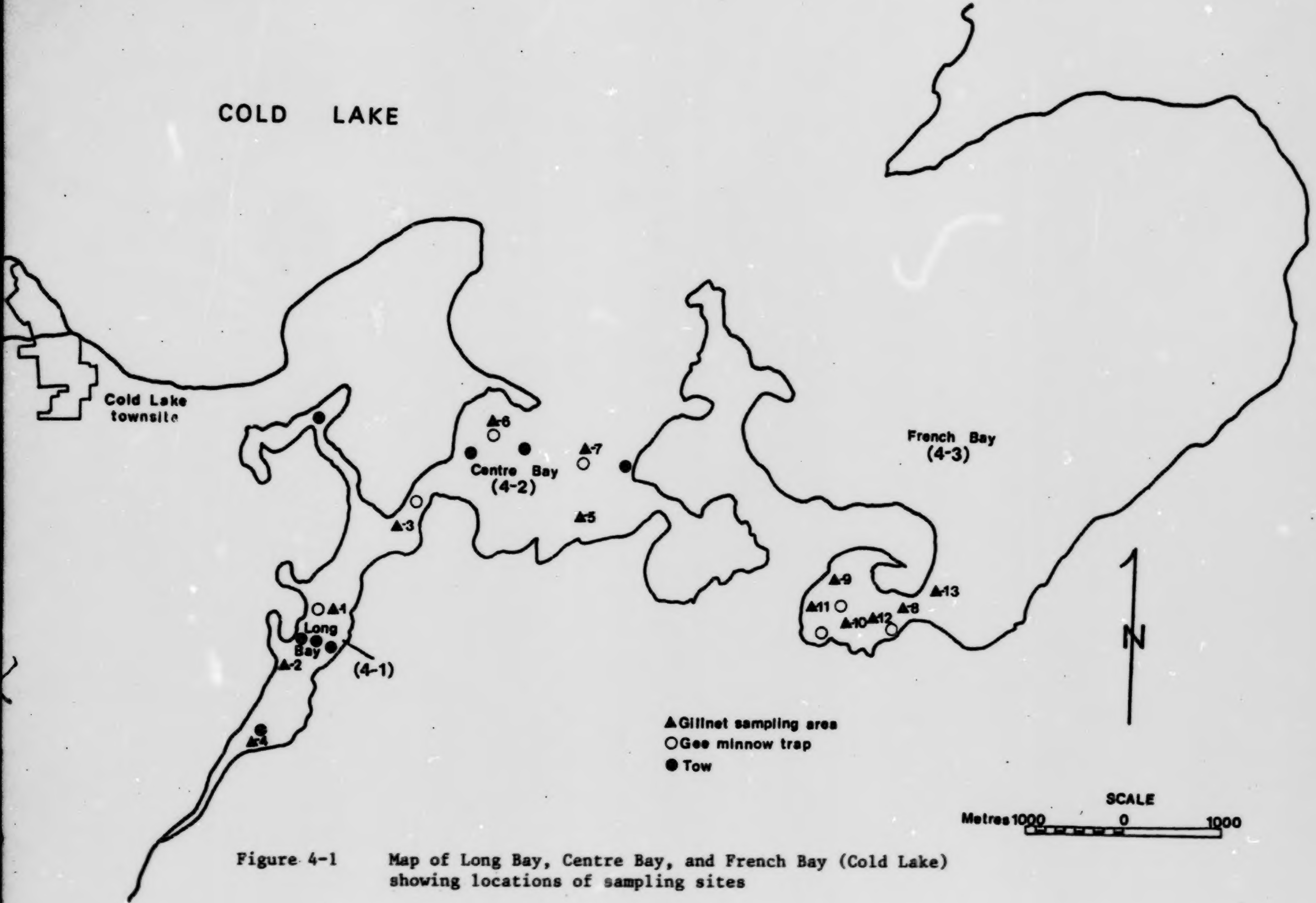

COLD LAKE
Cold Lake townsite
▲1
▲2
▲3
▲4
Long Bay
(4-1)
▲6
▲7
Centre Bay
(4-2)
▲5
French Bay
(4-3)
▲9
▲11
▲10
▲12
▲8
▲13
N
▲Gillnet sampling area
○Gee minnow trap
● Tow
SCALE
Metres 1000
0
1000

Figure 4-1 Map of Long Bay, Centre Bay, and French Bay (Cold Lake) showing locations of sampling sites

## LAKE SITE

**Site Number** 4-1
**Lake Name** Cold Lake
**Location** Long Bay (Figure 4-1)

## SITE CHARACTERISTICS

**Depth Range**

**Shoreline Features**

**Aquatic Vegetation**

**Substrate Type**

## SURFACE TEMPERATURE

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | Apr | | | | | May | | | | | | Jul | Oct |
| | 26 | 27 | 28 | 29 | 30 | 1 | 2 | 6 | 7 | 8 | 13 | 15-16 | 13-14 |
| **Temperature** | 6°C | 8.5 | 9 | 8.5 | 10 | 10 | 10 | 12 | 12.5 | 12 | 13.5 | 20 | 3 |

Temperatures recorded at Sampling Area 1

## METHODS

| Date | Method | |
|---|---|---|
| Apr 25-30 | 12 gillnets | |
| May 1-13 | 14 gillnets | |
| May 8, 12-13 | Minnow trap | |
| May 23-24 | ¶Three-minute tow | See Table 4-1 |
| Jul 15-16 | 3 gillnets | |
| Oct 13-14 | 3 gillnets | |

MINNOW TRAP DATA

| Date | No. traps | Time | Results |
|---|---|---|---|
| May 8 | ? | 4 hr | no fish |
| May 12-13 | 10 | 22 hr | no fish |

¶Supplementary data

FISH CAPTURES

| Species | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CP h x100 | CPh x100 | CPh x100 | CPh x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | 0.40 | | | 0.13 | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 45.46 | 35.34 | 25.93 | 35.61 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | 41.77 | | 13.92 | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 4.57 | 36.95 | | 13.84 | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 19.45 | 1.61 | 35.19 | 18.75 | | | | |
| Yellow walleye | 3.37 | 3.21 | | 2.19 | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 503.75h | 62.25h | 54h | 206.7h | | | | |
| Total Catch | 369 | 74 | 33 | 158.7 | | | | |
| Catch/Unit Effort | 0.733/h | 1.189/h | 0.611/h | 0.768/h | | | | |

**LAKE SITE**

**Site Number** 4-2

**Lake Name** Cold Lake

**Location** Centre Bay (Figure 4-1)

**SITE CHARACTERISTICS**

**Depth Range**

**Shoreline Features**

**Aquatic Vegetation**

**Substrate Type**

**SURFACE TEMPERATURE**

| **Date** | May<br>6 | 7 | 8 | 14 | Jul<br>15-16 | Oct<br>13-14 |
|---|---|---|---|---|---|---|
| **Temperature** | 12 | 11 | 10.5 | 14 | 20 | 3°C |

**METHODS**

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| Apr 27 | Gillnet | |
| May 6-14 | 5 gillnets | |
| May 13-14 | Minnow traps | |
| May 23-24 | ¶Three-minute tows | See Table 4-2 |
| July 15-16 | Gillnet | |
| Oct 13-14 | Gillnet | |

**MINNOW TRAP DATA**

| **Date** | **No. Traps** | **Time** | **Results** |
|---|---|---|---|
| May 13-14 | 10 | 23 hr | no fish |

¶Supplementary data

FISH CAPTURES

| Species | Gillnet<br>Spring<br>CP h x100 | <br>Summer<br>CP h x100 | <br>Fall<br>CP h x100 | <br>Mean<br>CP h x100 | Minnow Seine<br>Spring<br>CPM$^2$ x100 | <br>Summer<br>CPM$^2$ x100 | <br>Fall<br>CPM$^2$ x100 | <br>Mean<br>CPM$^2$ x100 |
|---|---|---|---|---|---|---|---|---|
| Lake whitefish | 1.67 | | | 0.56 | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 36.74 | 47.62 | 28.17 | 37.51 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | 52.38 | | 17.46 | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | 42.86 | | 14.29 | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 5.85 | | 39.44 | 15.10 | | | | |
| Yellow walleye | | 9.52 | | 3.17 | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 119.75h | 21h | 17.75h | 52.83h | | | | |
| Total Catch | 53 | 32 | 12 | 32.3 | | | | |
| Catch/Unit Effort | 0.443/h | 1.524/h | 0.676/h | 0.612/h | | | | |

## LAKE SITE

Site Number 4-3

Lake Name Cold Lake

Location French Bay (Figure 4-1)

## SITE CHARACTERISTICS

Depth Range

Shoreline Features

Aquatic Vegetation

Substrate Type

## SURFACE TEMPERATURE

| | | | |
|---|---|---|---|
| Date | May 6 | May 7 | May 11 |
| Temperature | 10°C | 9°C | 9.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 6 | Gillnet | |
| 7 | Gillnet, minnow traps | |
| 8 | Gillnet | |
| 11 | Gillnet, minnow and beach seine, minnow traps | |
| 14-15 | Gillnet | |
| 23-24 | ¶Three-minute tows | See Table 4-3 |

MINNOW TRAP DATA

| Date | No.Traps | Time | Results |
|---|---|---|---|
| May 7 | 5 | 6 hr | no fish |
| May 11 | 2 | 4 hr | 1 spottail shiner, 1 fathead minnow |
| May 11/12 | 2 | 25 hr | no fish |

¶Supplementary data

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CP h x100 | CP h x100 | CP h x100 | CP h x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | 7.08 |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 56.64 |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  | 12.51 |  |  |  |
| Fathead minnow |  |  |  |  | 20.40 |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 7.96 |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  | 0.27 |  |  |  |
| Yellow perch | 1.77 |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 2.45 |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  | 0.27 |  |  |  |
| Total Effort | 113h |  |  |  | 367.6m$^2$ |  |  |  |
| Total Catch | 83 | NS | NS |  | 132 | NS | NS |  |
| Catch/Unit Effort | 0.735/h |  |  |  | 0.359/m$^2$ |  |  |  |

NS = not sampled

Table 4-2 Summary of length-frequency data for fish captured in Cold Lake (Long Bay), 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | 5 | | | | | | 368 | | | | | | | | | | | | 14 |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | 78.6 |
| 76-100 | | | | | | | | | | | | | | | | | | | | | 21.4 |
| 101-125 | | | | | | | | | 1.6 | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | 0.5 | | | | | | | | | | | | |
| 201-225 | | | | | | | | | 2.2 | | | | | | | | | | | | |
| 226-250 | | | | | | | | | 1.6 | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | 2.2 | | | | | | | | | | | | |
| 301-325 | | | | | | | | | 3.5 | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 3.5 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 3.8 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 1.4 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 4.4 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 5.2 | | | | | | | | | | | | |
| 451-475 | | | 20.0 | | | | | | 7.3 | | | | | | | | | | | | |
| 476-500 | | | 60.0 | | | | | | 11.4 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 10.1 | | | | | | | | | | | | |
| 526-550 | | | 20.0 | | | | | | 6.5 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 6.5 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 7.1 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | 4.6 | | | | | | | | | | | | |
| 626-650 | | | | | | | | | 4.4 | | | | | | | | | | | | |
| 651-675 | | | | | | | | | 2.7 | | | | | | | | | | | | |
| 676-700 | | | | | | | | | 1.4 | | | | | | | | | | | | |
| 701-725 | | | | | | | | | 1.1 | | | | | | | | | | | | |
| 726-750 | | | | | | | | | 1.6 | | | | | | | | | | | | |
| 751-775 | | | | | | | | | 1.4 | | | | | | | | | | | | |
| 776-800 | | | | | | | | | 0.8 | | | | | | | | | | | | |
| 801-825 | | | | | | | | | 1.1 | | | | | | | | | | | | |
| 826-850 | | | | | | | | | 0.3 | | | | | | | | | | | | |
| 851-875 | | | | | | | | | 0.5 | | | | | | | | | | | | |
| 876-900 | | | | | | | | | | | | | | | | | | | | | |
| 901-925 | | | | | | | | | 0.8 | | | | | | | | | | | | |
| 926-950 | | | | | | | | | | | | | | | | | | | | | |
| 951-975 | | | | | | | | | 0.3 | | | | | | | | | | | | |
| 976-1000 | | | | | | | | | | | | | | | | | | | | | |
| 1001-1025 | | | | | | | | | | | | | | | | | | | | | |
| 1026-1050 | | | | | | | | | | | | | | | | | | | | | |
| 1051-1075 | | | | | | | | | | | | | | | | | | | | | |
| 1076-1800 | | | | | | | | | 0.3 | | | | | | | | | | | | |

Table 4-4 Continued,

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | 58 | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | 3.5 | | | | | | |
| 351-375 | | | | | | | | | | | | | | | 10.3 | | | | | | |
| 376-400 | | | | | | | | | | | | | | | 15.5 | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 27.6 | | | | | | |
| 426-450 | | | | | | | | | | | | | | | 15.5 | | | | | | |
| 451-475 | | | | | | | | | | | | | | | 17.2 | | | | | | |
| 476-500 | | | | | | | | | | | | | | | 6.9 | | | | | | |
| 501-525 | | | | | | | | | | | | | | | 1.7 | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | 1.7 | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 4-4 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | 125 | | | 20 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | 2.4 | | | | | | | | | | | | | | | |
| 126-150 | | | | | | 0.8 | | | | | | | | | | | | | | | |
| 151-175 | | | | | | 5.6 | | | | | | | | | | | | | | | |
| 176-200 | | | | | | 2.4 | | | | | | | | | | | | | | | |
| 201-225 | | | | | | 4.0 | | | | | | | | | | | | | | | |
| 226-250 | | | | | | 12.8 | | | | | | | | | | | | | | | |
| 251-275 | | | | | | 40.0 | | | | | | | | | | | | | | | |
| 276-300 | | | | | | 19.2 | | | 5.0 | | | | | | | | | | | | |
| 301-325 | | | | | | 9.6 | | | | | | | | | | | | | | | |
| 326-350 | | | | | | 1.6 | | | 5.0 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 5.0 | | | | | | | | | | | | |
| 426-450 | | | | | | 0.8 | | | 15.0 | | | | | | | | | | | | |
| 451-475 | | | | | | 0.8 | | | 15.0 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 10.0 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 5.0 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 15.0 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 20.0 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 5.0 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 4-1 Catch per unit effort for four gillnet sampling areas on Long Bay, Spring 1981. Catch per unit effort (x100) in indicated for each species captured.

|  | Sampling Area |  |  |  |
|---|---|---|---|---|
|  | 1 | 2 | 3 | 4 |
| Effort | 207.75h | 112h | 183h | 1h |
| Total Catch | 122 | 77 | 157 | 13 |
| Catch/unit Effort | 0.587/h | 0.688/h | 0.858/h | 13.0/h |
| Species | CPh x 100 | CPh x 100 | CPh x 100 | CPh x 100 |
| Lake whitefish |  |  | 1.09 |  |
| Northern pike | 28.88 | 50.89 | 54.10 | 1300 |
| ¶White sucker | 1.93 | 3.57 | 8.20 |  |
| ¶Yellow perch | 23.59 | 9.82 | 20.77 |  |
| Yellow walleye | 4.33 | 4.46 | 1.64 |  |

---

¶Six three-minute tows, 23 and 24 May 1981 resulted in no whice sucker larvae, 9141 yellow perch larvae. Catch/min 507.83.

Table 4-2 Catch per unit effort for three gillnet sampling areas on Centre Bay, Spring 1981. Catch per unit effort (x100) is indicated for each species captured.

| | Sampling Area | | |
|---|---|---|---|
| | 5 | 6 | 7 |
| Effort | 76.25h | 20.5h | 23h |
| Total Catch | 31 | 13 | 9 |
| Catch/unit Effort | 0.407/h | 0.634/h | 0.391/h |
| Species | CPh x 100 | CPh x 100 | CPh x 100 |
| Lake whitefish | | 4.88 | 4.35 |
| Northern pike | 34.10 | 48.78 | 34.78 |
| ¶Yellow perch | 6.56 | 9.76 | |

---

¶ Three three-minute tows, 23 and 24 May resulted in no white sucker larvae, 71 yellow perch larvae. Catch/min 7.89.

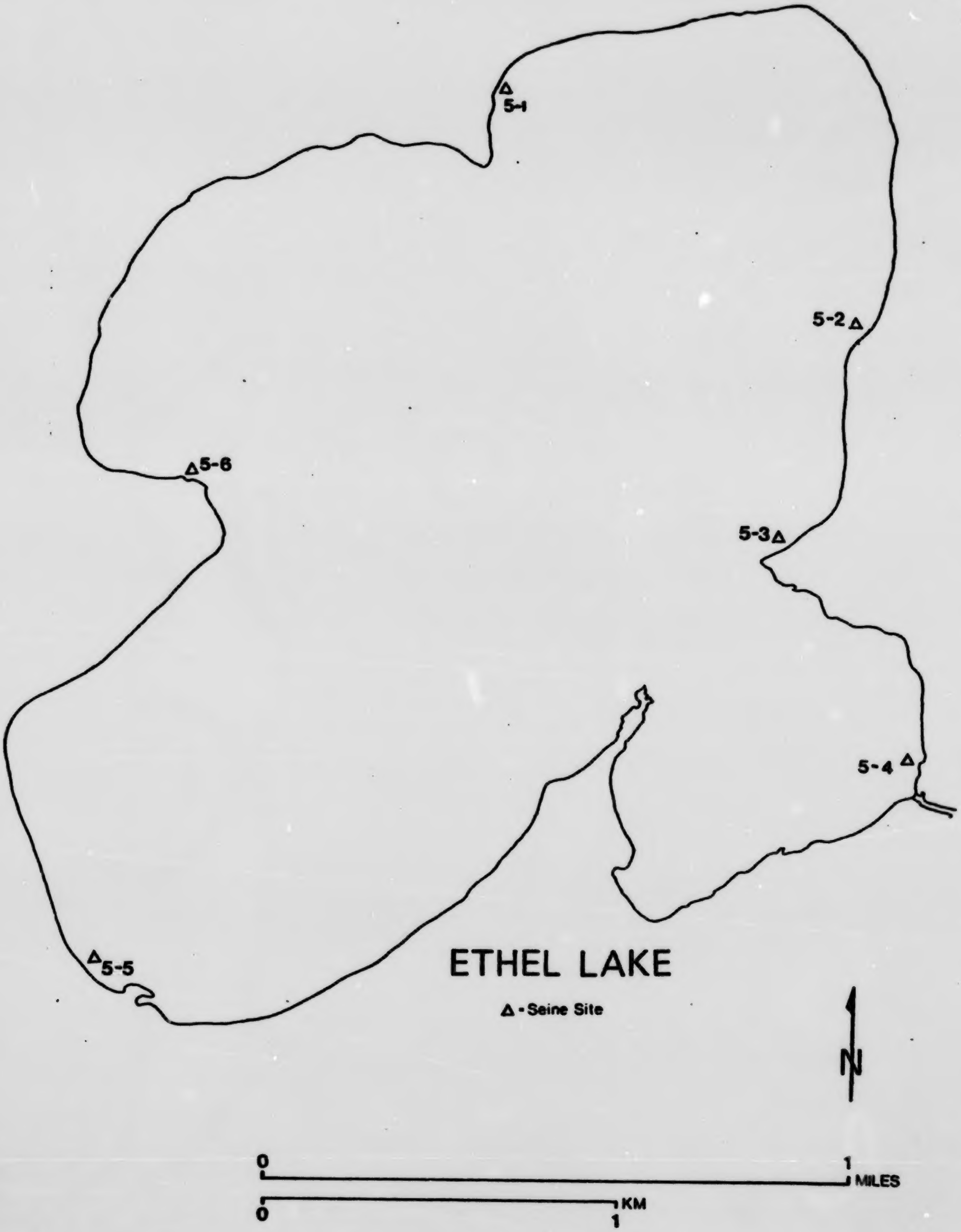
Table 4-3 Catch per unit effort for six gillnet sampling areas on French Bay, Spring 1891. Catch per unit effort (x100) is indicated for each species captured.

| | Sampling Areas | | | | | |
|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 13 |
| Effort | 19.5h | 23.5h | 23h | 5h | 21h | 21h |
| Total Catch | 19 | 11 | 22 | 1 | 14 | 16 |
| Catch/unit effort | 0.974/h | 0.468/h | 0.956/h | 0.200/h | 0.667/h | 0.762/h |
| Species | CPhx100 | CPhx100 | CPhx100 | CPhx100 | CPhx100 | CPhx100 |
| Lake whitefish | | | | | 9.52 | 28.57 |
| Northern pike | 92.31 | 42.55 | 82.61 | 20.00 | 42.86 | 33.33 |
| ¶White sucker | 5.13 | 4.26 | 8.70 | | 14.29 | 9.52 |
| ¶Yellow perch | | | 4.35 | | | 4.76 |

¶Two three-minute tows 23 and 24 May 1981 resulted in 11 white sucker larvae (Catch/min 1.83) and 1 yellow perch larvae (Catch/min 0.17).

## 5.0 ETHEL LAKE

Six sampling sites (numbers 5-1 to 5-6) were established on Ethel Lake (Figure 5-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Ethel Lake are presented in Table 5-1 (catch-per-unit-effort) and Table 5-2 (length frequencies).


5-1
5-2
5-3
5-4
5-5
5-6
ETHEL LAKE
△ - Seine Site
N
0
1
MILES
KM
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1

Figure 5-1. Map of Ethel Lake showing sampling sites.

**LAKE SITE**

Site Number 5-1

Lake Name Ethel Lake

Location See Figure 5-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Stable bank with grasses and overhanging willow, dogwood, poplar, birch. |
| Aquatic Vegetation | Sparse. Small bulrush patches approximately 4 m from shore. |
| Substrate Type | Sand 100%. |

**SURFACE TEMPERATURE**

| | | | | |
|---|---|---|---|---|
| Date | May 3 | May 19 | Jul 17 | Oct 14 |
| Temperature | 8°C | 13°C | 23°C | 7.5°C |

**METHODS**

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine<br>Minnow seine | 0.5-1.6m<br>1.25m |
| May 19 | Beach seine<br>Minnow seine | 0.5-1.6m<br>1.25m |
| Jul 17 | Beach seine<br>Minnow seine | 0.5-1.6m<br>1.25m |
| Oct 14 | Beach seine<br>Minnow seine | 0.5-1.6m<br>1.25m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  | 0.33 |  | 0.11 |  | 1.63 |  | 0.54 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  | 1.63 |  | 0.54 | 19.18 | 4.90 |  | 6.39 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  | 24.49 |  | 8.16 |  | 73.47 |  | 24.49 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  | 163.24 |  | 54.41 | 0.82 | 416.33 |  | 139.05 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 3.67 | 4.90 |  | 2.86 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2m² | 612.6m² | 612.6m² | 816.8m² | 245.0m² | 122.5m² | 81.7m² | 149.7m² |
| Total Catch | 0 | 1162 | 0 | 387.3 | 58 | 614 | 0 | 224 |
| Catch/Unit Effort | 0.00/m² | 1.897/m² | 0.00/m² | 0.474/m² | 0.237/m² | 5.012/m² | 0.00/m² | 1.496/m² |

## LAKE SITE

Site Number 5-2

Lake Name Ethel Lake

Location See Figure 5-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Stable bank, 1 m high. Grasses and overhanging willow, birch. Some aspen. |
| Aquatic Vegetation | Bulrushes extending 100-150m from shoreline forming 75-100% cover. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 3 | May 19 | Jul 17 | Oct 14 |
|---|---|---|---|---|
| Temperature | 8°C | 13°C | 23°C | 7.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine | 1.5m |
| | Minnow seine | 1.0m |
| May 19 | Beach seine | 1.5m |
| | Minnow seine | 1.0m |
| Jul 17 | Beach seine | 1.5m |
| | Minnow seine | 1.0m |
| Oct 14 | Minnow seine | 1.0m |

FISH CAPTURES

| | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| Species | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 0.33 | 157.69 | | 79.01 | 84.23 | 3.27 | | 29.17 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | 123.41 | | 61.71 | 0.33 | 0.82 | | 0.38 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 0.82 | 205.68 | | 103.25 | 24.16 | 53.88 | | 26.01 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.16 | | | 0.08 | 3.92 | 11.43 | 0.82 | 5.39 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1225.2m$^2$ | 612.6m$^2$ | | 918.9m$^2$ | 306.3m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 183.8m$^2$ |
| Total Catch | 16 | 2982 | NS | 1499 | 345 | 85 | 1 | 143.7 |
| Catch/Unit Effort | 0.013/m$^2$ | 4.868/m$^2$ | | 1.631/m$^2$ | 1.126/m$^2$ | 0.694/m$^2$ | 0.008/m$^2$ | 0.782/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 5-3
Lake Name Ethel Lake
Location See Figure 5-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Stable bank with grasses and willows. |
| Aquatic Vegetation | Emergent vegetation dense. Horsetail, bulrush, cattails common. |
| Substrate Type | Organic 100%. |

## SURFACE TEMPERATURE

| Date | May 3 | May 19 | Jul 17 | Oct 14 |
|---|---|---|---|---|
| Temperature | 9°C | 14°C | -- | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Minnow seine | 0.75m |
| May 19 | Minnow seine | 0.75m |
| Jul 17 | -- | -- |
| Oct 14 | Minnow seine | 0.75m |

FISH CAPTURES

| Species | Beach Seine<br>Spring | Beach Seine<br>Summer | Beach Seine<br>Fall | Beach Seine<br>Mean | Minnow Seine<br>Spring | Minnow Seine<br>Summer | Minnow Seine<br>Fall | Minnow Seine<br>Mean |
|---|---|---|---|---|---|---|---|---|
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  | 68.98 |  |  | 34.49 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  | 0.82 | 0.41 |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | NS | NS | NS |  | 245.0m²<br>169<br>0.689/m² | NS | 122.5m²<br>1<br>0.008/m² | 183.8m²<br>85<br>0.463/m² |

NS = not sampled

## LAKE SITE

Site Number 5-4

Lake Name Ethel Lake

Location See Figure 5-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. Shallow area 0.5m in depth extends 30m from shore. |
| Shoreline Features | Low bank, 0.5m high. Aspen, poplar, willows, birch and spruce. |
| Aquatic Vegetation | Emergent vegetation, mainly bulrushes, forming 75-100% cover and extending 30-100m from shoreline. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 3 | May 19 | Jul 17 | Oct 14 |
|---|---|---|---|---|
| Temperature | 9.5°C | 15°C | 23°C | 7.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.5-0.8m |
| May 23 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.5-0.8m |
| Jul 17 | Minnow seine | 0.5-8.0m |
| Oct 14 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.5-0.8m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 3.84 |  |  | 1.92 | 348.68 | 208.98 | 8.98 | 188.88 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  | 0.33 |  | 0.11 |
| Yellow perch | 0.08 |  |  | 0.04 |  | 2.94 |  | 0.98 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  | 0.33 | 0.16 |  | 0.33 |  | 0.11 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2m$^2$ | NS | 612.6 | 918.9m$^2$ | 306.3m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 183.8m$^2$ |
| Total Catch | 48 |  | 2 | 25 | 1079 | 256 | 11 | 448.7 |
| Catch/Unit Effort | 0.039/m$^2$ |  | 0.003/m$^2$ | 0.027/m$^2$ | 3.523 /m$^2$ | 2.089/m$^2$ | 0.089/m$^2$ | 2.441/m |

NS = not sampled

## LAKE SITE

| | |
|---|---|
| Site Number | 5-5 |
| Lake Name | Ethel Lake |
| Location | See Figure 5-1 |

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Cut bank, 1m high. Poplar, aspen, willows, grasses. |
| Aquatic Vegetation | Scouring rush forms a 10-20m band 20 m offshore. Forms 50% cover. |
| Substrate Type | Sand 95%. Pebble 5%. |

## SURFACE TEMPERATURE

| | | | |
|---|---|---|---|
| Date | May 3 | May 19 | Jul 17 |
| Temperature | 9.5°C | 14°C | 23°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine | 0.8-1.5 |
| | Minnow seine | 0.5-0.75 |
| May 19 | Beach seine | 0.8-1.5 |
| | Minnow seine | 0.5-0.75 |
| Jul 17 | Beach seine | 0.8-1.5 |
| | Minnow seine | 0.5-0.75 |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | 1.31 | | 0.65 | 111.00 | 4.08 | | 57.54 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | 1.47 | | 0.74 | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | 2.61 | | 1.31 | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | 1.14 | | 0.57 | | 12.24 | | 6.12 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m$^2$ | 612.6m$^2$ | NS | 612.6m$^2$ | 306.3m$^2$ | 122.5m$^2$ | NS | 214.4m$^2$ |
| Total Catch | 0 | 40 | | 20 | 340 | 20 | | 180 |
| Catch/Unit Effort | 0.00/m$^2$ | 0.065/m$^2$ | | 0.033/m$^2$ | 1.110/m$^2$ | 0.163/m$^2$ | | 0.839/m$^2$ |

NS = not sampled

## LAKE SITE

| | |
|---|---|
| **Site Number** | 5-6 |
| **Lake Name** | Ethel Lake |
| **Location** | See Figure 5-1 |

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth. |
| **Shoreline Features** | Stable bank, 1m high. Willows, grasses. Some deadfall. |
| **Aquatic Vegetation** | Emergent vegetation (bulrush) forming 100% cover extending 50-75m from shoreline. Also 100% cover of submergent vegetation. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| | | | |
|---|---|---|---|
| **Date** | May 3 | May 19 | Oct 14 |
| **Temperature** | 9.5°C | 15°C | 7.5°C |

## METHODS

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| May 3 | Beach seine | 1.0-1.5 |
| | Minnow seine | 0.75-1.0 |
| May 23 | Beach seine | 1.0-1.5 |
| | Minnow seine | 0.75-1.0 |
| Oct 14 | Beach seine | 1.0-1.5 |
| | Minnow seine | 0.75-1.0 |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x10 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 0.16 | 0.08 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 1.22 | | 0.16 | 0.69 | 158.99 | | 9.80 | 84.39 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | 0.33 | 0.16 | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 0.98 | | 23.02 | 12.00 | | | 0.82 | 0.41 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | 0.66 | | 11.43 | 6.05 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1225.2m$^2$ | NS | 612.6m$^2$ | 918.9m$^2$ | 306.3m$^2$ | NS | 122.5m$^2$ | 214.4m$^2$ |
| Total Catch | 27 | | 145 | 86 | 489 | | 27 | 258 |
| Catch/Unit Effort | 0.022/m$^2$ | | 0.237/m$^2$ | 0.094/m$^2$ | 1.597/m$^2$ | | 0.220/m$^2$ | 1.203/m$^2$ |

NS = not sampled

Table 5-1 Summary of catches per effort of fish taken by various methods for Ethel Lake, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 1715.3 $m^2$ | | 490.1 $m^2$ | | 471.8 $m^2$ | | 892.4 $m^2$ | |
| Total Catch | 2480 | | 975 | | 40 | | 1285 | |
| Catch/Unit Effort | 1.446/$m^2$ | | 1.989/$m^2$ | | 0.070/$m^2$ | | 1.439/$m^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 0.41 | 0.2 | | | 0.14 | 0.1 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 138.11 | 95.5 | 3.06 | 1.5 | 2.10 | 30.0 | 47.76 | 42.3 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.06 | <0.1 | 18.57 | 9.3 | | | 6.21 | 3.1 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | 0.06 | <0.1 | | | 0.17 | 2.4 | 0.77 | 0.8 |
| yellow perch | 4.96 | 3.4 | 117.53 | 59.1 | 0.17 | 2.4 | 40.87 | 21.6 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 1.40 | 1.0 | 59.38 | 29.9 | 4.55 | 65.1 | 21.78 | 32.0 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 5-1 Concluded.

|  | Beach Seine |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring |  | Summer |  | Fall |  | Total Mean |  |
| Effort | 5513.4 m$^2$ |  | 1837.8 m$^2$ |  | 1837.8 m$^2$ |  | 3063.0 m$^2$ |  |
| Total Catch | 91 |  | 4184 |  | 147 |  | 1474 |  |
| Catch/Unit Effort | 0.017/m$^2$ |  | 2.277/m$^2$ |  | 0.080/m$^2$ |  | 0.481/m$^2$ |  |
|  |  |  |  |  |  |  | Means |  |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  | 0.11 | 0.1 | 0.05 | 0.7 | 0.05 | 0.3 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 1.20 | 72.3 | 53.54 | 23.5 | 0.05 | 0.7 | 18.26 | 32.2 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  | 49.78 | 21.9 | 0.10 | 1.4 | 16.63 | 7.8 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| yellow perch | 0.42 | 25.3 | 123.84 | 54.4 | 7.67 | 95.9 | 43.98 | 58.5 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 0.04 | 2.4 | 0.38 | 0.2 | 0.10 | 1.4 | 0.17 | 1.3 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |

Table 5-2 Summary of length-frequency data for fish captured in Ethel Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentage.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 2 | 3 | | | | | | | | | | | 8 | 1 | |
| 0-25 | | | | | | | | | | | | | | | | | | | 62.5 | | |
| 26-50 | | | | | | | | | | | | | | | | | | | 25.0 | | |
| 51-75 | | | | | | | | | | | | | | | | | | | 12.5 | 100.0 | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | 66.7 | | | | | | | | | | | | | |
| 126-150 | | | | | | | 100.0 | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | 33.3 | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 5-2 Continued.

| | | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | 3 | 5 | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | 100.0 | 20.0 | | | | | | | |
| 51-75 | | | | | | | | | | | | | | 80.0 | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 5-2 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | 1 | | | 11 | 27 | | | | | 17 | | | | | | | | | | | |
| 0-25 | 100.0 | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | 90.9 | 18.5 | | | | | 94.1 | | | | | | | | | | | |
| 51-75 | | | | 9.1 | 40.7 | | | | | 5.9 | | | | | | | | | | | |
| 76-100 | | | | | 14.8 | | | | | | | | | | | | | | | | |
| 101-125 | | | | | 14.8 | | | | | | | | | | | | | | | | |
| 126-150 | | | | | 7.4 | | | | | | | | | | | | | | | | |
| 151-175 | | | | | 3.7 | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## 6.0 MANATOKAN LAKE

Six sampling sites (numbers 6-1 to 6-6) were established on Angling Lake (Figure 6-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Manatokan Lake are presented in Table 6-1 (catch-per-unit effort) and Table 6-2 (length frequencies).

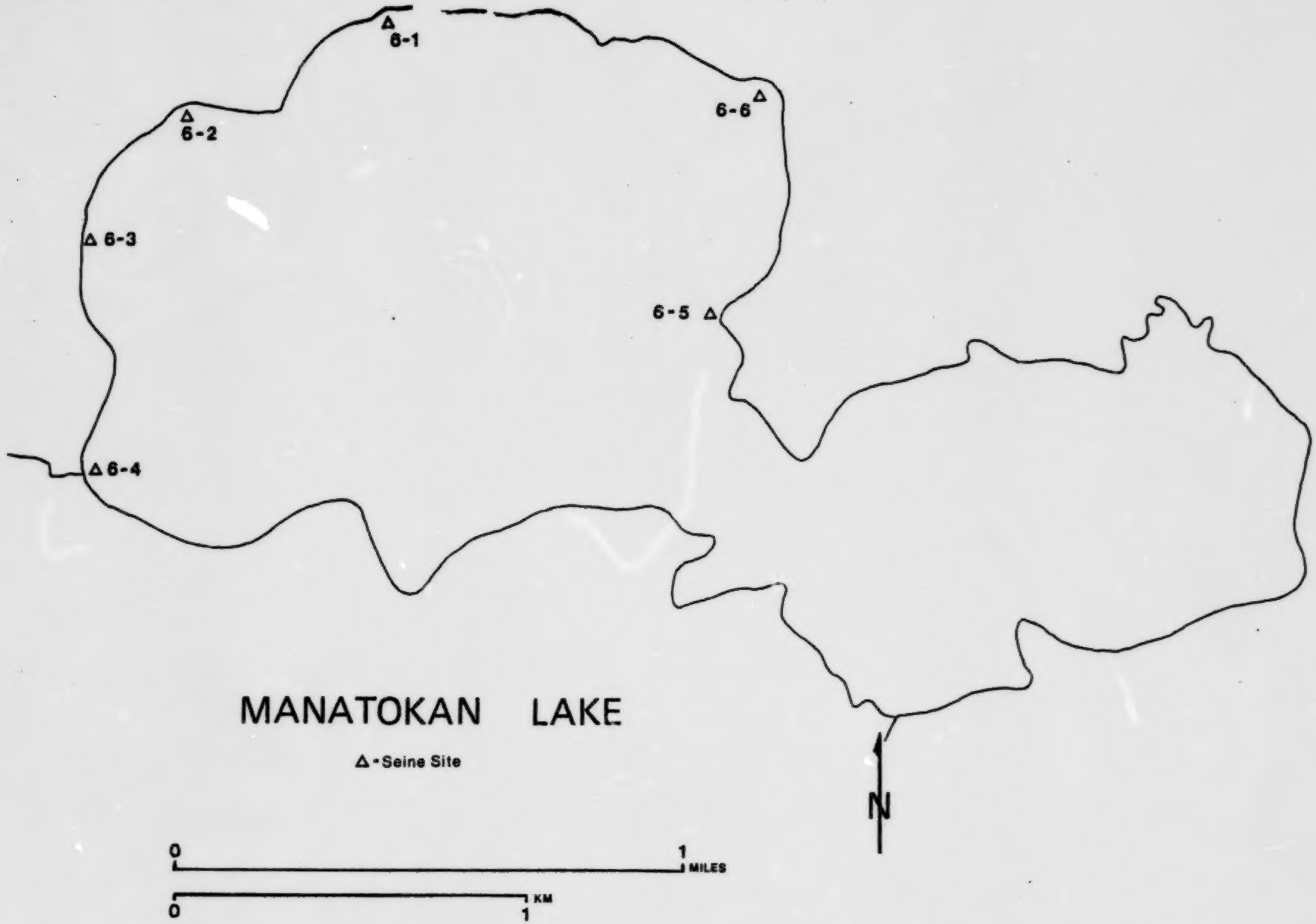

6-1
6-2
6-3
6-4
6-5
6-6
MANATOKAN LAKE
Δ - Seine Site
N
0
1
MILES
0
1
KM

Figure 6-1 Map of Manatokan Lake showing locations of sampling sites.

**LAKE SITE**

Site Number 6-1

Lake Name Manatokan Lake

Location See Figure 6-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| Depth Range | Gradual to moderate increase in depth from shoreline: 10m-1.25m, 30m-1.25m, 60m-2.5m. |
| Shoreline Features | Mainly rocky bank. Grasses and poplar. |
| Aquatic Vegetation | Emergent and subemergent for 20-30m offshore. 100% cover. |
| Substrate Type | Sand 80%. Silt 20%. |

**SURFACE TEMPERATURE**

| Date | May 3 | May 15 | Jul 13 | Oct 12 |
|---|---|---|---|---|
| Temperature | 8.5°C | 12.5°C | 26°C | 5.5°C |

**METHODS**

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| May 15 | Minnow seine<br>Beach seine | 1.0m<br>1.5-1.75m |
| Jul 13 | Minnow seine | 1.0m |
| Oct 12 | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.73 | | | | | 0.82 | | 0.27 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | 0.08 | | | | 1.63 | | 3.27 | 1.63 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 16.41 | | | | | 4.90 | | 1.63 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1225.2m$^2$ | | | 1225.2m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 211 | NS | NS | 211 | 4 | 7 | 4 | 5 |
| Catch/Unit Effort | 0.172/m$^2$ | | | 0.172/m$^2$ | 0.016/m$^2$ | 0.057/m$^2$ | 0.033/m$^2$ | 0.031/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 6-2
Lake Name Manatokan Lake
Location See Figure 6-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Very gradual increase in depth from shoreline: 30m-1m, 60m-1.5m, 90m-1.5m. |
| Shoreline Features | Low bank, 1 m high. Grasses and bushes. |
| Aquatic Vegetation | Emergent vegetation offers 100% cover near shore. Pond lily and bulrush. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 3 | May 15 | Oct 12 |
|---|---|---|---|
| Temperature | 8°C | 12.5°C | 5.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| May 15 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| Jul 13 | Minnow seine | 1.0m |
| Oct 12 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 0.49 |  |  | 0.25 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  | 0.16 | 0.08 | 0.41 | 6.53 |  | 2.31 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 19.43 |  |  | 9.72 |  | 0.82 |  | 0.27 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2m | NS | 612.6m$^2$ | 918.9m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 244 |  | 1 | 122.5 | 1 | 9 | 0 | 3.3 |
| Catch/Unit Effort | 0.199/m$^2$ |  | 0.002/m$^2$ | 0.133/m$^2$ | 0.004/m$^2$ | 0.074/m$^2$ | 0.00/m$^2$ | 0.020/m$^2$ |

NS = not sampled

LAKE SITE

|  |  |
|---|---|
| Site Number | Site 6-3 |
| Lake Name | Manatokan Lake |
| Location | See Figure 6-1 |

SITE CHARACTERISTICS

|  |  |
|---|---|
| Depth Range | Very gradual increase in depth from shoreline: 30m-1m, 60m-1.5m, 90m-1.5m. |
| Shoreline Features | Low bank, 1m high. Grasses and bushes. |
| Aquatic Vegetation | Reeds dominate for 30m off shore. |
| Substrate Type | Sand 100%. |

SURFACE TEMPERATURE

|  |  |  |  |
|---|---|---|---|
| Date | May 3 | May 15 | Jul 13 |
| Temperature | 8°C | 12.5°C | 26°C |

METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| May 15 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| Jul 13 | Minnow seine | 1.0m |
| Oct 12 | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | 0.41 | | 4.08 | 1.49 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 3.51 | | | | | 685.60 | | 228.53 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 1225.2$m^2$<br>43<br>0.035/$m^2$ | NS | NS | 1225.2$m^2$<br>43<br>0.035/$m^2$ | 245.0$m^2$<br>1<br>0.004/$m^2$ | 204.2$m^2$<br>1400<br>6.856/$m^2$ | 122.5$m^2$<br>5<br>0.041/$m^2$ | 190.6$m^2$<br>469<br>2.461/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number 6-4
Lake Name Manatokan Lake
Location See Figure 6-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-1.25m, 60m-1.5m. |
| Shoreline Features | No true bank. Reeds form shoreline. |
| Aquatic Vegetation | Emergent and submergent vegetation. Scouring rush and pond lilies extend 40m from shoreline. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| | | |
|---|---|---|
| Date | May 3 | May 15 |
| Temperature | 8.5°C | 12.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine | 1.5-1.75m |
| | Minnow seine | 1.0m |
| May 15 | Beach seine | 1.5-1.75m |
| | Minnow seine | 1.0m |
| Jul 13 | Minnow seine | 1.0m |
| Oct 12 | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 0.24 |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback | 0.24 |  |  |  | 1.63 |  | 0.82 | 0.82 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 0.98 |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2m² | NS | NS | 1225.2m² | 122.5m² | 122.5m² | 122.5m² | 122.5m² |
| Total Catch | 18 |  |  | 18 | 2 | 0 | 1 | 1 |
| Catch/Unit Effort | 0.015/m² |  |  | 0.015/m² | 0.016/m² | 0.000/m² | 0.008/m² | 0.008/m² |

NS = not sampled

## LAKE SITE

Site Number 6-5

Lake Name Manatokan Lake

Location See Figure 6-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-1.25m, 60m-2.5m. |
| Shoreline Features | Rocky shore with moderate slope. Bushes and trees. |
| Aquatic Vegetation | Emergent and submergent vegetation. Scouring rush and bulrush extends 20m off shore. |
| Substrate Type | Rubble 100%. |

## SURFACE TEMPERATURE

| | | |
|---|---|---|
| Date | May 3 | May 15 |
| Temperature | 8°C | 12.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| May 15 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| Oct 12 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | 1.23 | 0.62 |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1225.2m$^2$ | NS | 612.6m$^2$ | 918.9m$^2$ | 245.0m$^2$ | NS | 81.6m$^2$ | 108.9m$^2$ |
| Total Catch | 0 | | 0 | 0 | 0 | | 1 | 0.5 |
| Catch/Unit Effort | 0.00/m$^2$ | | 0.00/m$^2$ | 0.00/m$^2$ | 0.00/m$^2$ | | 0.012/m$^2$ | 0.005/m$^2$ |

NS = not sampled

## LAKE SITE

| | |
|---|---|
| Site Number | 6-6 |
| Lake Name | Manatokan Lake |
| Location | See Figure 6-1 |

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Moderate increase in depth from shoreline: 10m-1.25m, 30m-1.25m, 60m-2.5m. |
| Shoreline Features | Well-defined beach. |
| Aquatic Vegetation | Submergent vegetation 20-30m from shoreline. Pond lily. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 3 | May 15 | Oct 12 |
|---|---|---|---|
| Temperature | 8°C | 13.5°C | 5.5°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 3 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| May 15 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| Jul 13 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |
| Oct 12 | Beach seine<br>Minnow seine | 1.5-1.75m<br>1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  | 2.45 |  | 0.82 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.41 |  |  | 0.14 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  | 430.95 | 1.31 | 144.09 |  | 0.82 |  | 0.27 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 816.8m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 0 | 2640 | 8 | 882.7 | 1 | 4 | 0 | 1.7 |
| Catch/Unit Effort | 0.00/m$^2$ | 4.309/m$^2$ | 0.013/m$^2$ | 1.081/m$^2$ | 0.004/m$^2$ | 0.033/m$^2$ | 0.00/m$^2$ | 0.010/m$^2$ |

Table 6-1 Summary of catches per effort of fish taken by various methods for Manatokan Lake, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

|  | Minnow Seine |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring |  | Summer |  | Fall |  | Total Mean |  |
| Effort | 1470.2 m² |  | 735.1 m² |  | 694.3 m² |  | 966.5 m² |  |
| Total Catch | 9 |  | 1420 |  | 11 |  | 480 |  |
| Catch/Unit Effort | 0.006/m² |  | 1.931/m² |  | 0.016/m² |  | 0.497/m² |  |
|  |  |  |  |  |  |  | Means |  |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  | 0.12 | 0.1 |  |  | 0.04 | <0.1 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnpw |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  | 0.39 | 0.2 |  |  | 0.13 | 0.1 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  | 1.08 | 0.6 | 1.58 | 100.0 | 0.89 | 33.5 |
| Ninespine stickleback | 0.61 | 100.0 |  |  |  |  | 0.20 | 33.3 |
| yellow perch |  |  | 191.48 | 99.2 |  |  | 63.83 | 33.1 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |

continued

Table 6-1 Concluded.

| | Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 7963.8 $m^2$ | | 612.6 $m^2$ | | 1837.8 $m^2$ | | 3471.4 $m^2$ | |
| Total Catch | 517 | | 2640 | | 9 | | 1055.3 | |
| Catch/Unit Effort | 0.065/$m^2$ | | 4.310/$m^2$ | | 0.005/$m^2$ | | 0.304/$m^2$ | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.18 | 2.8 | | | | | 0.06 | 0.9 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.03 | 0.5 | | | | | 0.01 | 0.2 |
| Burbot | | | | | | | | |
| Brook stickleback | 0.06 | 0.9 | | | 0.05 | 10.2 | 0.04 | 3.7 |
| Ninespine stickleback | | | | | | | | |
| yellow perch | 6.20 | 95.8 | 430.95 | 100.0 | 0.44 | 89.8 | 145.86 | 95.2 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 6-2 Summary of length-frequency data for fish captured in Manatokan Lake, 1981. Total catch repesents number captured, length-frequencies are expressed in percentage.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch (N) | | | | | | | 1 | 13 | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | 100.0 | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | 15.4 | | | | | | | | | | | | | |
| 351-375 | | | | | | | | 15.4 | | | | | | | | | | | | | |
| 376-400 | | | | | | | | 15.4 | | | | | | | | | | | | | |
| 401-425 | | | | | | | | 23.1 | | | | | | | | | | | | | |
| 426-450 | | | | | | | | 7.7 | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | 7.7 | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | 15.4 | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 6-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | 3 | 3 | | | | | 11 | 6 | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | 100.0 | | | | | | 100.0 | 100.0 | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | 33.3 | | | | | | | |
| 151-175 | | | | | | | | | | | | | | 33.3 | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | 33.3 | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 6-2 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 7 | 98 | | | | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | 14.3 | 1.0 | | | | | | | | | | | | | | | | |
| 51-75 | | | | 14.3 | 35.7 | | | | | | | | | | | | | | | | |
| 76-100 | | | | 28.6 | 20.4 | | | | | | | | | | | | | | | | |
| 101-125 | | | | 28.6 | 13.3 | | | | | | | | | | | | | | | | |
| 126-150 | | | | 14.3 | 10.2 | | | | | | | | | | | | | | | | |
| 151-175 | | | | | 10.2 | | | | | | | | | | | | | | | | |
| 176-200 | | | | | 2.0 | | | | | | | | | | | | | | | | |
| 201-225 | | | | | 3.1 | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | 4.1 | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## 7.0 MARIE LAKE

Ten sampling sites (numbers 7-1 to 7-10) were established on Marie Lake (Figure 7-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Marie Lake are presented in Table 7-1 (catch-per-unit-effort) and Table 7-2 (length frequencies).

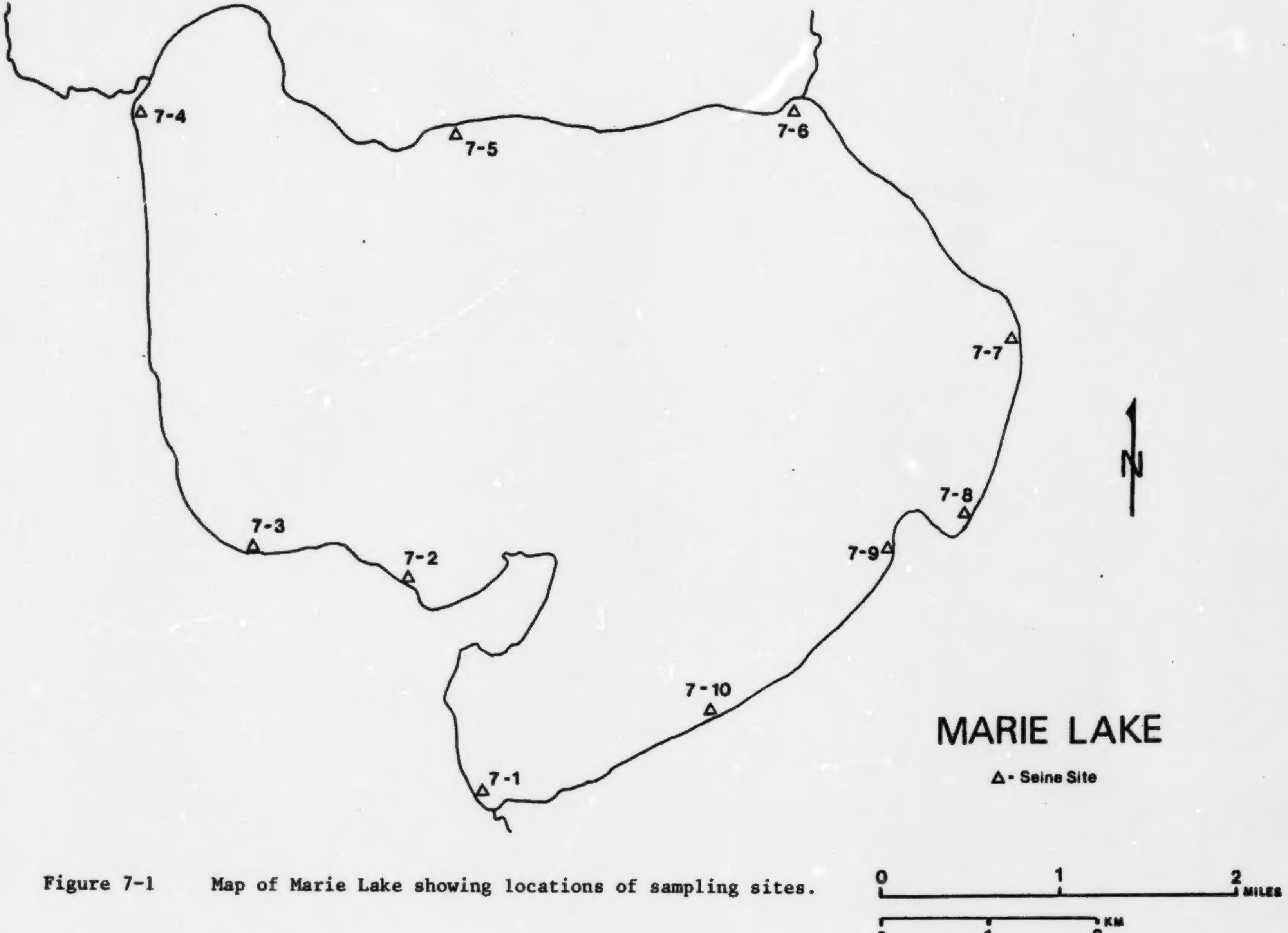

7-4
7-5
7-6
7-7
7-8
7-9
7-3
7-2
7-10
7-1
MARIE LAKE
Δ - Seine Site
0
1
2 MILES
0
1
2 KM
N

Figure 7-1 Map of Marie Lake showing locations of sampling sites.

LAKE SITE

Site Number 7-1

Lake Name Marie Lake

Location See Figure 7-1

SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Bank 1m high. Willows and some grasses. |
| Aquatic Vegetation | Small patches of submergent vegetation. |
| Substrate Type | Silt/mud 85%. Gravel 5%. Boulder 10%. |

SURFACE TEMPERATURE

| Date | May 16 | Jul 20 | Oct 13 |
|---|---|---|---|
| Temperature | 8°C | 20°C | 7°C |

METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |
| Jul 20 | Minnow seine | 1.0m |
| Oct 13 | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 0.16 |  |  |  | 1.63 |  | 0.82 | 0.82 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 0.82 |  |  | 0.27 |
| Logperch |  |  |  |  |  | 0.82 |  | 0.27 |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 612.6m$^2$<br>1<br>0.002/m$^2$ | NS | NS | 612.6m$^2$<br>1<br>0.002/m$^2$ | 122.5m$^2$<br>3<br>0.025/m$^2$ | 122.5m$^2$<br>1<br>0.008/m$^2$ | 122.5m$^2$<br>1<br>0.008/m$^2$ | 122.5m$^2$<br>1.7<br>0.014/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 7-2

Lake Name Marie Lake

Location See Figure 7-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Bank 1 m high. Primarily boulder and rubble. Some white spruce. |
| Aquatic Vegetation | Patches of submergent vegetation. Cattails. |
| Substrate Type | Sand 90%. Organic 10%. |

## SURFACE TEMPERATURE

| | | | |
|---|---|---|---|
| Date | May 16 | Jul 20 | Oct 13 |
| Temperature | 7°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |
| Jul 20 | Minnow seine | 1.0m |
| Oct 13 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6$m^2$ | NS | 612.6$m^2$ | 612.6$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 122.5$m^2$ |
| Total Catch | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Catch/Unit Effort | 0.00/$m^2$ | | 0.00/$m^2$ | 0.00/$m^2$ | 0.00/$m^2$ | 0.00/$m^2$ | 0.00/$m^2$ | 0.00/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number 7-3

Lake Name Marie Lake

Location See Figure 7-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Bank 1m high. Made up of 40% boulder, 50% rock, 10% gravel. |
| Aquatic Vegetation | None. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| | | |
|---|---|---|
| Date | May 16 | Oct 13 |
| Temperature | 7.5°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine | 2.0m |
| | Minnow seine | 1.0m |
| Oct 13 | Beach seine | 2.0m |
| | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 3.26 |  |  | 1.63 |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  | 0.16 | 0.08 |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 612.6$m^2$ | NS | 612.6$m^2$ | 612.6$m^2$ | 122.5$m^2$ | NS | 122.5$m^2$ | 122.5$m^2$ |
| Total Catch | 20 |  | 1 | 10.5 | 0 |  | 0 | 0 |
| Catch/Unit Effort | 0.033/$m^2$ |  | 0.002/$m^2$ | 0.017/$m^2$ | 0.00/$m^2$ |  | 0.00/$m^2$ | 0.00/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number 7-4

Lake Name Marie Lake

Location See Figure 7-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Bank 0.5m high. Composed of 80% sand, 20% pebble. |
| Aquatic Vegetation | Sparse submergent vegetation forming 10 to 15% cover. |
| Substrate Type | Sand 90%. Organic debris 10%. |

## SURFACE TEMPERATURE

| Date | May 16 | Jul 20 | Oct 13 |
|---|---|---|---|
| Temperature | 9°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |
| Jul 20 | Minnow seine | 1.0m |
| Oct 13 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  | 0.16 | 0.08 |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  | 8.16 | 1.63 | 3.26 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 612.6m$^2$ | NS | 612.6m$^2$ | 612.6m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ |
| Total Catch | 0 |  | 1 | 0.5 | 0 | 10 | 2 | 4 |
| Catch/Unit Effort | 0.00/m$^2$ |  | 0.002/m$^2$ | 0.001/m$^2$ | 0.00/m$^2$ | 0.082/m$^2$ | 0.016/m$^2$ | 0.033/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 7-5

Lake Name Marie Lake

Location See Figure 7-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Sloping bank 1 m high. Composed of 80% boulder, 20% rock. Extends 15m into water. |
| Aquatic Vegetation | None. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| | | | |
|---|---|---|---|
| Date | May 16 | Jul 20 | Oct 13 |
| Temperature | 8°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |
| Jul 20 | Minnow seine | 1.0m |
| Oct 13 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  | 0.49 | 0.25 |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  | 3.27 | 1.09 |
| Slimy sculpin |  |  |  |  |  | 0.82 |  | 0.27 |
| Total Effort | 612.6m$^2$ | NS | 612.6m$^2$ | 612.6m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ |
| Total Catch | 0 |  | 3 | 1.5 | 0 | 1 | 4 | 1.7 |
| Catch/Unit Effort | 0.00/m$^2$ |  | 0.005/m$^2$ | 0.002/m$^2$ | 0.00/m$^2$ | 0.008/m$^2$ | 0.033/m$^2$ | 0.014/m$^2$ |

NS = not sampled

### LAKE SITE

Site Number 7-6

Lake Name Marie Lake

Location See Figure 7-1

### SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from 0.5 to 1.0m 60m from shore |
| Shoreline Features | Bank 1m high composed of 40% rock, 20% gravel. Willows and grasses. |
| Aquatic Vegetation | Submergent vegetation extending 75-100m off shore. 100% cover. |
| Substrate Type | Silt/mud 55%. Organic 45%. |

### SURFACE TEMPERATURE

| Date | May 16 | Jul 20 | Oct 13 |
|---|---|---|---|
| Temperature | 11°C | 22°C | 7°C |

### METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine | 2.0m |
| | Minnow seine | 1.0m |
| Jul 20 | Beach seine | 2.0m |
| | Minnow seine | 1.0m |
| Oct 13 | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | 0.82 | | | 0.27 |
| Burbot | | | | | | | 0.82 | 0.27 |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | 0.49 | | 0.25 | 0.82 | | | 0.27 |
| Yellow perch | | 65.95 | | 32.98 | 1.63 | 1.63 | | 1.09 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | 6.86 | | 3.43 | | 24.49 | | 8.16 |
| Logperch | | 0.49 | | 0.25 | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m² | 612.6m² | NS | 612.6m² | 122.5m² | 122.5m² | 122.5m² | 122.5m² |
| Total Catch | 0 | 452 | | 226 | 4 | 32 | 1 | 12.3 |
| Catch/Unit Effort | 0.00/m² | 0.738/m² | | 0.369/m² | 0.033/m² | 0.261/m² | 0.008/m² | 0.101/m² |

NS = not sampled

## LAKE SITE

**Site Number** 7-7

**Lake Name** Marie Lake

**Location** See Figure 7-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth |
| **Shoreline Features** | Bank 0.5m high, composed of 60% rock 30% boulder, and 10% gravel. Some alder and grasses. |
| **Aquatic Vegetation** | None. |
| **Substrate Type** | Rubble 75%. Boulder 25%. |

## SURFACE TEMPERATURE

| **Date** | May 16 | Jul 20 | Oct 13 |
|---|---|---|---|
| **Temperature** | 8°C | 20°C | 7°C |

## METHODS

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| May 16 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |
| Jul 20 | Minnow seine | 1.0m |
| Oct 13 | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | 6.53 | 13.06 | 0.82 | 6.80 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | 0.82 | | 0.27 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | 45.71 | | 15.24 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | 0.82 | 0.27 |
| Logperch | | | | | | 0.82 | | 0.27 |
| Slimy sculpin | | | | | | | | |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 612.6$m^2$<br>0<br>0.00/$m^2$ | NS | NS | 612.6$m^2$<br>0<br>0.00/$m^2$ | 122.5$m^2$<br>8<br>0.065/$m^2$ | 122.5$m^2$<br>74<br>0.604/$m^2$ | 122.5$m^2$<br>2<br>0.016/$m^2$ | 122.5$m^2$<br>28<br>0.229/$m^2$ |

NS = not sampled

## LAKE SITE

|  |  |
|---|---|
| Site Number | 7-8 |
| Lake Name | Marie Lake |
| Location | See Figure 7-1 |

## SITE CHARACTERISTICS

|  |  |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Bank 1.0m high. Composed of 80% rubble, 10% boulder, 10% gravel. Some alder, spruce, poplar and grasses. |
| Aquatic Vegetation | None. |
| Substrate Type | Rubble 95%. Boulder 5%. |

## SURFACE TEMPERATURE

| Date | May 16 | Jul 20 | Oct 13 |
|---|---|---|---|
| Temperature | 7.5°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine | 2.0m |
|  | Minnow seine | 1.0m |
| Jul 20 | Minnow seine | 1.0m |
| Oct 13 | Beach seine | 2.0m |
|  | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | 2.45 | 12.24 | | 4.89 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | 11.26 | 5.63 | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | 0.82 | 0.82 | 0.55 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m² | NS | 612.6m² | 612.6m² | 122.5m² | 122.5m² | 122.5m² | 122.5m² |
| Total Catch | 0 | | 69 | 34.5 | 3 | 16 | 1 | 6.7 |
| Catch/Unit Effort | 0.00/m² | | 0.113/m² | 0.056/m² | 0.025/m² | 0.131/m² | 0.008/m² | 0.054/m² |

NS = not sampled

**LAKE SITE**

Site Number 7-9

Lake Name Marie Lake

Location See Figure 7-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Bank 2.0m high. Composed of 80% boulder, 20% rubble. Poplar, willows and grasses. |
| Aquatic Vegetation | None. |
| Substrate Type | Boulder 80%. Rubble 20%. |

**SURFACE TEMPERATURE**

| | |
|---|---|
| Date | May 16 |
| Temperature | 8.5° |

**METHODS**

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine | 2.0m |
| | Minnow seine | 1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.16 | | | 0.16 | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m$^2$ | NS | NS | 612.6m$^2$ | 122.5m$^2$ | NS | NS | 122.5m$^2$ |
| Total Catch | 1 | | | 1 | 0 | | | 0 |
| Catch/Unit Effort | 0.002/m$^2$ | | | 0.002/m$^2$ | 0.00/m$^2$ | | | 0.00/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 7-10

Lake Name Marie Lake

Location See Figure 7-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Bank 0.5m high, composed of 95% rock and 5% boulder. Some poplar, willows, alder. |
| Aquatic Vegetation | None. |
| Substrate Type | Sand 90%. Organic 10%. |

## SURFACE TEMPERATURE

| | | |
|---|---|---|
| Date | May 16 | Jul 20 |
| Temperature | 9°C | 20°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 16 | Beach seine<br>Minnow seine | 2.0m<br>1.0m |
| Jul 20 | Minnow seine | 1.0m |

## FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 612.6m$^2$<br>0<br>0.00/m$^2$ | NS | NS | 612.6m$^2$<br>0<br>0.00/m$^2$ | 122.5m$^2$<br>0<br>0.00/m$^2$ | 122.5m$^2$<br>0<br>0.00/m$^2$ | NS | 122.5m$^2$<br>0<br>0.00/m$^2$ |

NS = not sampled

Table 7-1 Summary of catches per effort of fish taken by various methods for Marie Lake, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 1225.2 m² | | 980.2 m² | | 980.2 m² | | 1061.9 m² | |
| Total Catch | 18 | | 134 | | 11 | | 54.3 | |
| Catch/Unit Effort | 0.015/m² | | 0.137/m² | | 0.011/m² | | 0.051/m² | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 1.06 | 72.2 | 3.16 | 23.1 | 0.20 | 17.9 | 1.47 | 37.7 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.08 | 5.6 | 0.10 | 0.7 | | | 0.06 | 2.1 |
| Burbot | | | | | 0.10 | 8.9 | 0.03 | 3.0 |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | 0.08 | 5.6 | | | | | 0.03 | 1.9 |
| yellow perch | 0.16 | 11.1 | 5.92 | 43.3 | | | 2.03 | 18.1 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.08 | 5.6 | 4.18 | 30.6 | 0.82 | 73.2 | 1.69 | 36.5 |
| Logperch | | | 0.31 | 2.3 | | | 0.10 | 0.8 |
| Slimy sculpin | | | | | | | | |

continued

Table 7-1 Concluded.

| | Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 6126.0 m$^2$ | | 612.6 m$^2$ | | 3063.0 m$^2$ | | 3267.2 m$^2$ | |
| Total Catch | 22 | | 452 | | 74 | | 182.7 | |
| Catch/Unit Effort | 0.004/m$^2$ | | 0.738/m$^2$ | | 0.024/m$^2$ | | 0.056/m$^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 0.02 | 6.3 | | | | | 0.01 | 2.1 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.34 | 93.7 | | | 0.10 | 4.1 | 0.15 | 32.6 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | 0.49 | 0.7 | | | 0.16 | 0.2 |
| yellow perch | | | 65.95 | 89.3 | 2.32 | 95.9 | 22.76 | 61.7 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | 6.86 | 9.3 | | | 2.29 | 3.1 |
| Logperch | | | 0.49 | 0.7 | | | 0.16 | 0.2 |
| Slimy sculpin | | | | | | | | |

Table 7-2 Summary of length-frequency data for fish captured in Marie Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentage.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | | | | | 7 | 1 | |
| 0-25 | | | | | | | | | | | | | | | | | | | 85.7 | | |
| 26-50 | | | | | | | | | | | | | | | | | | | 14.3 | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | 100.0 | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 7-2 Continued.

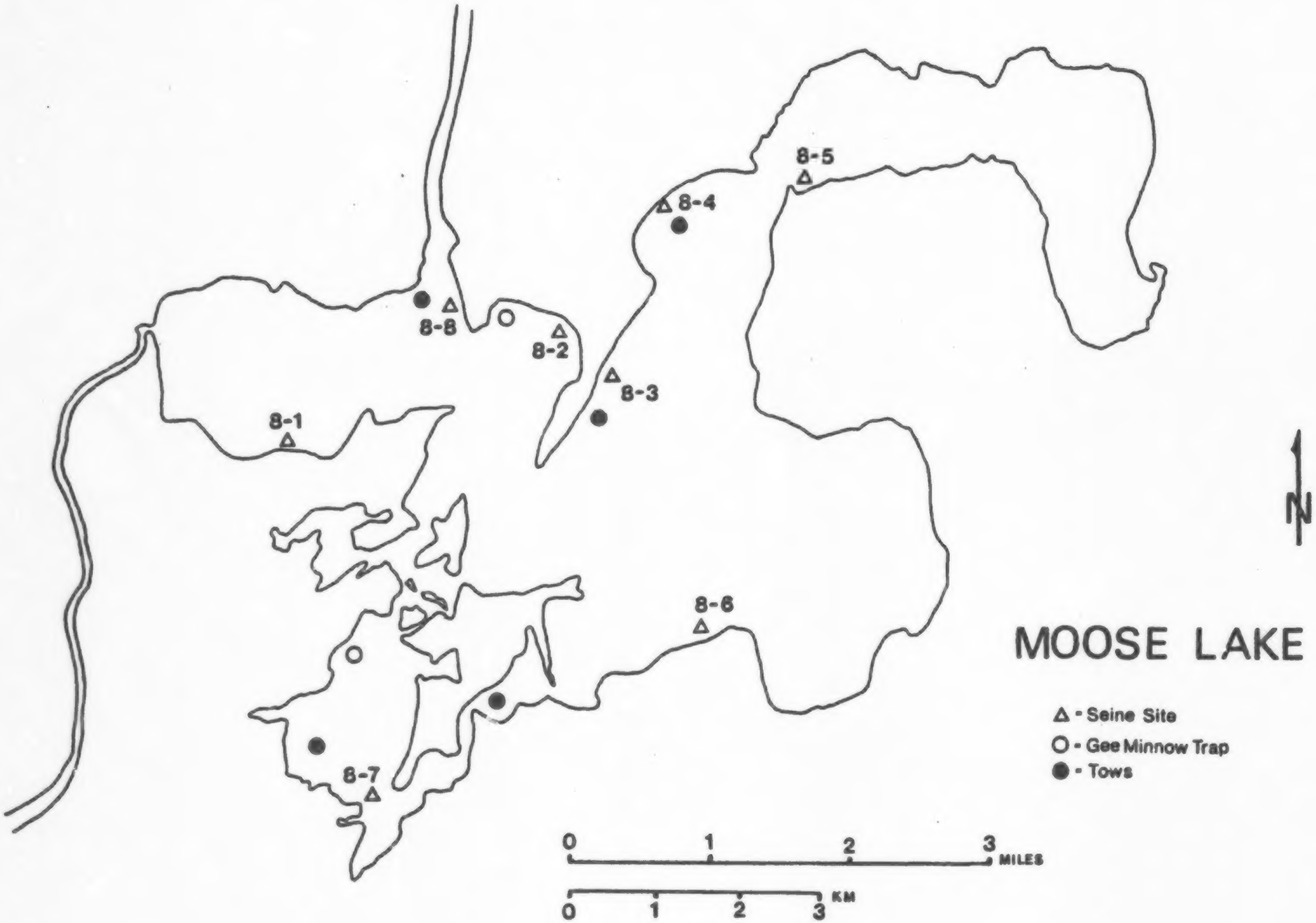
| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | 1 | 26 | | 1 | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | 100.0 | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | 100.0 | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | 4.4 | | | | | | | |
| 226-250 | | | | | | | | | | | | | | 30.8 | | | | | | | |
| 251-275 | | | | | | | | | | | | | | 11.5 | | | | | | | |
| 276-300 | | | | | | | | | | | | | | 4.4 | | | | | | | |
| 301-325 | | | | | | | | | | | | | | 15.4 | | | | | | | |
| 326-350 | | | | | | | | | | | | | | 15.4 | | | | | | | |
| 351-375 | | | | | | | | | | | | | | 11.5 | | | | | | | |
| 376-400 | | | | | | | | | | | | | | 7.7 | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 7-2 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | 3 | 3 | | 13 | 17 | | | | | 18 | 5 | | 4 | 2 | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | 23.1 | 17.7 | | | | | 77.8 | 100.0 | | 50.0 | 100.0 | | | | | | | |
| 51-75 | 100.0 | 100.0 | | 30.8 | 11.8 | | | | | 5.6 | | | 50.0 | | | | | | | | |
| 76-100 | | | | 46.2 | 11.8 | | | | | 16.7 | | | | | | | | | | | |
| 101-125 | | | | | 29.4 | | | | | | | | | | | | | | | | |
| 126-150 | | | | | 5.9 | | | | | | | | | | | | | | | | |
| 151-175 | | | | | 5.9 | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | 5.9 | | | | | | | | | | | | | | | | |
| 226-250 | | | | | 11.8 | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## 8.0 MOOSE LAKE

Eight sampling sites (numbers 8-1 to 8-8) were established on Moose Lake (Figure 8-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Moose Lake are presented in Table 8-1 (catch-per-unit-effort) and Table 8-2 (length frequencies). Supplementary data for evening seining conducted at some sites are presented in Tables 8-3 to 8-8.



8-5
8-4
8-8
8-2
8-3
8-1
N
8-6
MOOSE LAKE
△ - Seine Site
○ - Gee Minnow Trap
● - Tows
8-7
0
1
2
3
MILES
0
1
2
3
KM

Figure 8-1 Map of Moose Lake showing locations of sampling sites.

## LAKE SITE

**Site Number** 8-1

**Lake Name** Moose Lake

**Location** See Figure 8-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-1.25m, 60m-1.5m, 90m-1.75m |
| **Shoreline Features** | Bank 2 to 3m high, no slope. Grasses and trees. |
| **Aquatic Vegetation** | Emergent and submergent vegetation. 30% reeds. Some organic debris. |
| **Substrate Type** | Sand 90%. Gravel 10%. |

## SURFACE TEMPERATURE

| **Date** | Apr 30-May 2 | May 8-May 9 | May 24 | Jul 10 | Oct 10 (eve) |
|---|---|---|---|---|---|
| **Temperature** | 7°C | 12°C | 17°C | 20°C | 4°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Apr 30-May 2 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.5-1.0m |
| May 8-9 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.5-1.0m |
| May 24 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.5-1.0m |
| Jul 10 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.5-1.0m |
| Oct 3 | Minnow seine | 0.5-1.0m |
| Oct 10 | Minnow seine | 0.5-1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 7.29 | 51.42 |  | 29.36 | 57.94 | 31.02 |  | 44.48 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  | 0.16 |  | 0.08 |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  | 0.82 |  | 0.41 |
| Yellow perch | 0.49 | 205.68 |  | 103.09 |  | 77.55 |  | 38.78 |
| Yellow walleye |  | 0.49 |  | 0.25 |  |  |  |  |
| Iowa darter | 0.05 |  |  | 0.03 | 6.53 |  |  | 3.27 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1837.8m$^2$ | 612.6m$^2$ |  | 1225.2m$^2$ | 367.6m$^2$ | 122.5m$^2$ |  | 245.1/m$^2$ |
| Total Catch | 144 | 1579 | NS | 861.5 | 237 | 134 | NS | 185.5 |
| Catch/Unit Effort | 0.078/m$^2$ | 2.578/m$^2$ |  | 0.703/m$^2$ | 0.645/m$^2$ | 1.094/m$^2$ |  | 0.757/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 8-2
Lake Name Moose Lake
Location See Figure 8-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-1.5m, 60m-2.25m, 90m-4m. |
| Shoreline Features | Bank 2 to 3m high. Steep Slope. Grasses, shrubs, and trees. |
| Aquatic Vegetation | Submergent vegetation 10-20m from shoreline. Some organic debris. |
| Substrate Type | Sand 100% |

## SURFACE TEMPERATURE

| Date | Apr 30-May 2 | May 8-May 9 | May 24 | Jul 10 | Oct 3 | Oct 10 (eve) |
|---|---|---|---|---|---|---|
| Temperature | 9.5°C | 9°C | 17°C | 20°C | 8.5°C | 4°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Apr 30 - May 2 | Beach seine | 0-1.25m |
| | Minnow seine | 0.3-0.75m |
| May 8 - May 9 | Beach seine | 0-1.25m |
| | Minnow seine | 0.3-0.75m |
| May 24 | Beach seine | 0-1.25m |
| | Minnow seine | 0.3-0.75m |
| Jul 10 | Beach seine | 0-1.25m |
| | Minnow seine | 0.3-0.75m |
| Oct 3 | Beach seine | 0-1.25m |
| | Minnow seine | 0.3-0.75m |
| Oct 9 | ¶Evening seining | See Table 8-3 |
| Oct 10 | Beach seine | 0-1.25m |
| | Minnow seine | 0.3-0.75m |

Gee minnow traps were set in the vicinity of this site with no results.

¶Supplementary data

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 0.16 | 0.82 | 1.63 | 0.87 |  |  | 1.63 | 0.54 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 0.11 | 9.79 |  | 3.30 | 2.45 | 197.55 |  | 66.67 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  | 0.65 |  | 0.22 |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.54 |  | 0.82 | 0.45 |
| Ninespine stickleback | 0.05 |  |  | 0.02 |  |  |  |  |
| Yellow perch | 0.05 | 58.77 |  | 19.61 | 0.27 | 4.08 |  | 1.45 |
| Yellow walleye |  | 0.33 |  | 0.11 |  |  |  |  |
| Iowa darter | 0.11 |  |  | 0.04 | 7.34 |  |  | 2.45 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1837.8m² | 612.6m² | 612.6m² | 1021.0m² | 367.6m² | 122.5m² | 122.5m² | 204.2m² |
| Total Catch | 9 | 431 | 10 | 150 | 39 | 247 | 3 | 96.3 |
| Catch/Unit Effort | 0.005/m² | 0.704/m² | 0.016/m² | 0.147/m² | 0.106/m² | 2.016/m² | 0.024/m² | 0.472/m² |

## LAKE SITE

**Site Number** 8-3

**Lake Name** Moose Lake

**Location** See Figure 8-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-1m, 60m-1m, 90m-1.25m. |
| **Shoreline Features** | Bank 2 to 3m high. No slope. Trees, shrubs, grasses. |
| **Aquatic Vegetation** | Emergent reeds. Submergent vegetation. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| **Date** | Apr 30-<br>May 2 | May 8-<br>May 9 | May 24 | Jul 10 | Oct 3 |
|---|---|---|---|---|---|
| **Temperature** | 9.5°C | 9.5°C | 20°C | 20°C | 9°C |

## METHODS

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| Apr 30 - May 2 | Beach seine | 1.0m |
| | Minnow seine | 0.25-0.5m |
| May 8 - 9 | Beach seine | 1.0m |
| | Minnow seine | 0.25-0.5m |
| | ¶Evening seining | See Tables 8-4 to 8-5 |
| May 24 | Beach seine | 1.0m |
| | Minnow seine | 0.25-0.5m |
| May 25 | ¶Three-minute tows | See Table 8-1 |
| Jul 10 | Beach seine | 1.0m |
| | Minnow seine | 0.25-0.5m |
| Oct 3 | Minnow seine | 0.25-0.5m |
| Oct 9 | ¶Evening seining | See Tables 8-4 to 8-5 |
| Oct 10 | Minnow seine | 0.25-0.5m |

¶Supplementary data

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub | 0.05 |  |  | 0.03 |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 27.32 |  |  | 13.66 | 261.69 | 27.76 | 2.45 | 97.30 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback | 0.22 |  |  | 0.11 |  |  | 0.82 | 0.27 |
| Ninespine stickleback |  |  |  |  | 0.82 |  |  | 0.27 |
| Yellow perch | 154.21 | 5.88 |  | 80.05 | 4.62 | 832.65 |  | 279.09 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 0.05 | 0.33 |  | 0.19 | 0.82 |  | 1.63 | 0.82 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1837.8m$^2$ | 612.6m$^2$ | NS | 1225.2m$^2$ | 367.6m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 204.2m$^2$ |
| Total Catch | 3342 | 38 |  | 1690 | 985 | 1054 | 6 | 681.7 |
| Catch/Unit Effort | 1.819/m$^2$ | 0.062/m$^2$ |  | 1.379/m$^2$ | 2.679/m$^2$ | 8.604/m$^2$ | 0.049/m$^2$ | 3.338/m$^2$ |

NS = not sampled

## LAKE SITE

**Site Number** 8-4

**Lake Name** Moose Lake

**Location** See Figure 8-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-1.5m, 60m-1.75m, 90m-2.0m. |
| **Shoreline Features** | Bank 3 to 5m high. No slope. |
| **Aquatic Vegetation** | Submergent vegetation very dense approximately 15m from shoreline. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| Date | Apr 30-<br>May 2 | May 8-<br>May 9 | May 24 | Jul 10 | Oct 3 |
|---|---|---|---|---|---|
| Temperature | 8°C | 9.5°C | 17°C | 18°C | 9°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Apr 30 - May 2 | Beach seine | 1.5m |
| | Minnow seine | 0.5-1.5m |
| May 8 - 9 | Beach seine | 1.5m |
| | Minnow seine | 0.5-1.5m |
| May 9 | ¶Evening seining | See Tables 8-6 & 8-7 |
| May 24 | Beach seine | 1.5m |
| | Minnow seine | 0.5-1.5m |
| May 25 | ¶Three-minutes tows | See Table 8-1 |
| Jul 10 | Beach seine | 1.5m |
| | Minnow seine | 0.5-1.5m |
| Oct 3 | Beach seine | 1.5m |
| | Minnow seine | 0.5-1.5m |
| Oct 10 | Beach seine | 1.5m |
| | Minnow seine | 0.5-1.5m |

¶ Supplementary data

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.11 | | | 0.04 | | 0.82 | | 0.27 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 3.43 | | 0.65 | 1.36 | 44.34 | 0.82 | 115.10 | 53.42 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | 4.57 | 0.98 | 1.85 | | | | |
| Brook stickleback | 0.05 | 0.65 | 0.33 | 0.34 | 0.27 | | 1.63 | 0.63 |
| Ninespine stickleback | 1.52 | | 0.33 | 0.62 | | | 1.63 | 0.54 |
| Yellow perch | 28.62 | 4.90 | | 11.17 | 1.90 | 314.29 | 4.89 | 107.03 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 2.45 | 0.82 | 0.33 | 1.20 | 3.81 | | 5.71 | 3.17 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1837.8m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 1021.0m$^2$ | 367.6m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 204.2m$^2$ |
| Total Catch | 665 | 67 | 16 | 249.3 | 185 | 387 | 158 | 243.3 |
| Catch/Unit Effort | 0.362/m$^2$ | 0.109/m$^2$ | 0.026/m$^2$ | 0.244/m$^2$ | 0.503/m$^2$ | 3.159/m$^2$ | 1.289/m$^2$ | 1.192/m$^2$ |

## LAKE SITE

|  |  |
|---|---|
| Site Number | 8-5 |
| Lake Name | Moose Lake |
| Location | See Figure 8-1 |

## SITE CHARACTERISTICS

|  |  |
|---|---|
| Depth Range | Steep increase in depth from shoreline: 30m-12m, 60m-13.5m. |
| Shoreline Features | Steep bank. Well-defined beach along shoreline. |
| Aquatic Vegetation | Submergent vegetation 5m from shore. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | Apr 30-May 2 | May 8-May 9 | May 24 | Jul 10 | Oct 3 |
|---|---|---|---|---|---|
| Temperature | 6°C | 7°C | 16°C | 18°C | 10°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Apr 30 - May 2 | Beach seine | 0.5-5.0m |
|  | Minnow seine | 0-1.25m |
| May 8 - 9 | Beach seine | 0.5-5.0m |
|  | Minnow seine | 0-1.25m |
| May 24 | Beach seine | 0.5-5.0m |
|  | Minnow seine | 0-1.25m |
| Jul 10 | Beach seine | 0.5-5.0m |
|  | Minnow seine | 0-1.25m |
| Oct 3 | Beach seine | 0.5-5.0m |
|  | Minnow seine | 0-1.25m |
| Oct 10 | Beach seine | 0.5-5.0m |
|  | Minnow seine | 0-1.25m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  | 0.33 |  | 0.11 |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 0.22 | 4.57 | 0.65 | 1.81 | 4.08 | 14.69 | 87.35 | 35.37 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback | 0.15 |  |  | 0.05 | 0.54 |  | 0.27 | 0.27 |
| Ninespine stickleback | 0.22 | 9.14 |  | 3.12 |  | 0.82 |  | 0.27 |
| Yellow perch | 0.05 | 261.18 | 0.16 | 87.13 | 1.63 | 17.95 | 2.45 | 7.35 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 0.16 |  |  | 0.05 | 3.81 | 3.27 | 21.22 | 9.43 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1837.8m² | 612.6m² | 612.6m² | 1021.0m² | 367.6m² | 122.5m² | 122.5m² | 204.2m² |
| Total Catch | 15 | 1686 | 5 | 568.7 | 37 | 45 | 137 | 73 |
| Catch/Unit Effort | 0.008/m² | 2.752/m² | 0.008/m² | 0.557/m² | 0.101/m² | 0.367/m² | 1.118/m² | 0.358/m² |

## LAKE SITE

Site Number 8-6

Lake Name Moose Lake

Location See Figure 8-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-0.75, 60m-0.75m, 90-1.0m. |
| Shoreline Features | Bank 2 to 3m high. Steep slope. Overhanging shrubs and trees. |
| Aquatic Vegetation | Emergent reeds and submergent vegetation. 50-75% cover of bulrush which extends 50-100m off shore. |
| Substrate Type | Sand 100% |

## SURFACE TEMPERATURE

| Date | Apr 30-May 2 | May 8-May 9 | May 24 | Jul 10 | Oct 3 |
|---|---|---|---|---|---|
| Temperature | 8°C | 7°C | 17°C | 18°C | 10°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Apr 30 - May 2 | Beach seine | 0.75m |
| | Minnow seine | 0.25-0.5m |
| May 8 - 9 | Beach seine | 0.75m |
| | Minnow seine | 0.25-0.5m |
| May 24 | Beach seine | 0.75m |
| | Minnow seine | 0.25-0.5m |
| Jul 10 | Minnow seine | 0.25-0.5m |
| Oct 3 | Minnow seine | 0.25-0.5m |
| Oct 10 | Minnow seine | 0.25-0.5m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  | 97.66 | 57.06 | 3.26 | 52.96 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback | 4.24 |  |  |  | 0.27 |  |  | 0.09 |
| Yellow perch | 0.16 |  |  |  | 71.27 |  | 0.82 | 24.03 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 7.89 | 0.82 | 1.63 | 3.45 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 612.6$m^2$ | NS | NS | 612.6$m^2$ | 367.6$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 204.2$m^2$ |
| Total Catch | 27 |  |  | 27 | 651 | 72 | 7 | 243.3 |
| Catch/Unit Effort | 0.044/$m^2$ |  |  | 0.044/$m^2$ | 1.771/$m^2$ | 0.588/$m^2$ | 0.057/$m^2$ | 1.192/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number 8-7

Lake Name Moose Lake

Location See Figure 8-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-1.0m, 60m-1.25m, 90m-1.5m. |
| Shoreline Features | Grasses and overhanging shrubs. |
| Aquatic Vegetation | Submergent vegetation 15m from shoreline. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | Apr 30-May 2 | May 8-May 9 | May 24 | Jul 10 | Oct 3 |
|---|---|---|---|---|---|
| Temperature | 8°C | 11°C | 19°C | 18°C | 10°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Apr 30 - May 2 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.75m |
| May 8 - May 9 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.75m |
| May 24 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.75m |
| May 25 | ¶Two three-minute tows | See Table 8-1 |
| Jul 10 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.75m |
| Oct 3 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.75m |
| Oct 10 | Beach seine | 0.5-1.0m |
| | Minnow seine | 0.75m |

Gee minnow traps set in the vicinity of this site with no results.

¶ Supplementary data

FISH CAPTURES

| Species | Beach Seine<br>Spring<br>CPM$^2$ x100 | Beach Seine<br>Summer<br>CPM$^2$ x100 | Beach Seine<br>Fall<br>CPM$^2$ x100 | Beach Seine<br>Mean<br>CPM$^2$ x100 | Minnow Seine<br>Spring<br>CPM$^2$ x100 | Minnow Seine<br>Summer<br>CPM$^2$ x100 | Minnow Seine<br>Fall<br>CPM$^2$ x100 | Minnow Seine<br>Mean<br>CPM$^2$ x100 |
|---|---|---|---|---|---|---|---|---|
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.22 | | | 0.07 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 51.37 | 40.97 | | 30.78 | 211.20 | 1306.12 | 6.53 | 507.95 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | 0.33 | | 0.11 | | | | |
| Yellow perch | 27.91 | 1.95 | 0.16 | 10.01 | 7.35 | 19.59 | | 8.98 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.05 | 0.49 | | 0.18 | | | 9.79 | 3.26 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1837.8$m^2$ | 612.6$m^2$ | 612.6$m^2$ | 1021.0$m^2$ | 326.7$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 204.2$m^2$ |
| Total Catch | 1462 | 268 | 1 | 577 | 714 | 1624 | 20 | 786 |
| Catch/Unit Effort | 0.796/$m^2$ | 0.438/$m^2$ | 0.002/$m^2$ | 0.565/$m^2$ | 2.185/$m^2$ | 13.257$m^2$ | 0.163/$m^2$ | 3.849/$m^2$ |

### LAKE SITE

Site Number 8-8

Lake Name Moose Lake

Location See Figure 8-1

### SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-0.5m, 60m-1.0m, 90m-1.0m. |
| Shoreline Features | Bank 1m high. No slope. Trees and shrubs. |
| Aquatic Vegetation | Emergent reeds and submergent vegetation 30m from shoreline. |
| Substrate Type | Sand 100%. |

### SURFACE TEMPERATURE

| Date | Apr 30-May 2 | May 24 | Oct 3 | Oct 10 |
|---|---|---|---|---|
| Temperature | 9°C | 19°C | 12°C | 4°C |

### METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Apr 30 - May 1 | Minnow seine | 0.25-0.5m |
| May 8 - May 9 | Minnow seine | 0.25-0.5m |
| May 24 | Minnow seine | 0.25-0.5m |
| May 25 | ¶Three-minute tows | See Table 8-1 |
| Oct 3 | Minnow seine | 0.25-0.5 |
| Oct 9 | ¶Evening seining | See Table 8-8 |
| Oct 10 | Minnow seine | 0.25-0.5 |

¶ Supplementary data

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  | 146.08 |  | 0.82 | 73.45 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.27 |  |  | 0.14 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  | 0.27 |  |  | 0.14 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 3.26 |  | 2.45 | 2.86 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | NS | NS | NS |  | 367.6m²<br>551<br>1.499/m² | NS | 122.5m²<br>4<br>0.033/m² | 245.1m²<br>277.5<br>1.132/m² |

NS = not sampled

Table 8-1 Summary of catches per unit effort of fish taken by various methods, Moose Lake, 1981. Both catch per unit effort (x 100) and percentage of total catch are indicated for each species captured. NS inidcates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 3308.0 m² | | 857.6 m² | | 857.6 m² | | 1674.4 m² | |
| Total Catch | 3399 | | 3563 | | 335 | | 2432.3 | |
| Catch/Unit Effort | 1.206/m² | | 4.154/m² | | 0.391/m² | | 1.453/m² | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 0.12 | <0.1 | 0.23 | 0.6 | 0.12 | 0.2 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 104.61 | 86.7 | 233.66 | 56.2 | 30.78 | 78.8 | 123.02 | 73.9 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | 0.21 | 0.2 | | | 0.58 | 1.5 | 0.26 | 0.6 |
| Ninespine stickleback | 0.14 | 0.1 | 0.23 | 0.1 | 0.23 | 0.6 | 0.20 | 0.3 |
| ¶yellow perch | 11.28 | 9.4 | 180.84 | 43.5 | 1.17 | 3.0 | 64.43 | 18.6 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 4.36 | 3.6 | 0.58 | 0.1 | 6.06 | 15.5 | 3.67 | 6.4 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

---

¶ Catches of yellow perch larvae in five three- minute tows, 25 May 1981: Total larvae = 8; Catch/min = 0.52

Table 8-1 Concluded.

| | Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 11639.4 $m^2$ | | 3675.6 $m^2$ | | 2450.4 $m^2$ | | 5921.8 $m^2$ | |
| Total Catch | 5664 | | 4068 | | 32 | | 3254.7 | |
| Catch/Unit Effort | 0.486/$m^2$ | | 1.107/$m^2$ | | 0.013/$m^2$ | | 0.549/$m^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | 0.05 | 0.1 | 0.24 | 18.8 | 0.10 | 6.3 |
| Northern pike | 0.08 | 0.2 | 0.14 | 0.1 | | | 0.07 | 0.1 |
| Lake chub | 0.01 | <0.1 | | | | | <0.01 | <0.1 |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 14.17 | 29.1 | 17.79 | 16.1 | 0.33 | 25.0 | 10.76 | 23.4 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | 0.87 | 0.8 | | | 0.29 | 0.3 |
| Brook stickleback | 0.07 | 0.1 | 0.11 | 0.1 | 0.08 | 6.3 | 0.09 | 2.2 |
| Ninespine stickleback | 0.51 | 1.0 | 1.58 | 1.4 | 0.08 | 6.3 | 0.72 | 2.9 |
| yellow perch | 33.38 | 68.6 | 89.73 | 81.1 | 0.08 | 6.3 | 41.06 | 52.0 |
| Yellow walleye | | | 0.14 | 0.1 | 0.41 | 31.3 | 0.18 | 10.5 |
| Iowa darter | 0.46 | 0.9 | 0.27 | 0.2 | 0.08 | 6.3 | 0.27 | 2.5 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 8-2 Summary of length-frequency data for fish captured in Moose Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | 2 | | | 2 | | 3 | 26 | | | | | | | | | | | 163 | 92 | |
| 0-25 | | | | | | | | | | | | | | | | | | | 7.4 | | |
| 26-50 | | | | | | | | | | | | | | | | | | | 85.9 | 50.0 | |
| 51-75 | | | | | 100.0 | | 33.3 | 3.9 | | | | | | | | | | | 6.1 | 31.5 | |
| 76-100 | | | | | | | | 11.5 | | | | | | | | | | | 0.6 | 18.5 | |
| 101-125 | | | | | | | | 7.7 | | | | | | | | | | | | | |
| 126-150 | | | | | | | | 11.5 | | | | | | | | | | | | | |
| 151-175 | | | | | | | 66.7 | 23.1 | | | | | | | | | | | | | |
| 176-200 | | | | | | | | 7.7 | | | | | | | | | | | | | |
| 201-225 | | | | | | | | 3.9 | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | 3.9 | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | 3.9 | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | 50.0 | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | 50.0 | | | | | | 19.2 | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | 3.9 | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 8-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | | | 15 | | 11 | 14 | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | 33.3 | | 100.0 | 85.7 | |
| 51-75 | | | | | | | | | | | | | | | | | 26.7 | | | 14.3 | |
| 76-100 | | | | | | | | | | | | | | | | | 6.7 | | | | |
| 101-125 | | | | | | | | | | | | | | | | | 20.0 | | | | |
| 126-150 | | | | | | | | | | | | | | | | | 13.3 | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 8-2 Concluded.

| | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | 5 | 28 | | 81 | 120 | | | 5 | | 71 | 32 | | | | | | | | | | |
| 0-25 | 20.0 | | | | | | | | | 5.6 | | | | | | | | | | | |
| 26-50 | 60.0 | 75.0 | | 29.6 | 16.7 | | | 20.0 | | 94.4 | 96.9 | | | | | | | | | | |
| 51-75 | 20.0 | 25.0 | | 67.9 | 46.7 | | | 80.0 | | | 3.1 | | | | | | | | | | |
| 76-100 | | | | 1.2 | 16.7 | | | | | | | | | | | | | | | | |
| 101-125 | | | | 1.2 | 9.2 | | | | | | | | | | | | | | | | |
| 126-150 | | | | | 2.5 | | | | | | | | | | | | | | | | |
| 151-175 | | | | | 3.3 | | | | | | | | | | | | | | | | |
| 176-200 | | | | | 3.3 | | | | | | | | | | | | | | | | |
| 201-225 | | | | | 1.7 | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 8-3 Summary of catches per effort of fish taken by various methods for Moose Lake (site 8-2), 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort<br>Total Catch<br>Catch/Unit Effort | N.S. | | N.S. | | 122.5 m$^2$<br>1<br>0.008/m$^2$ | | | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | 0.82 | 100.0 | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 8-3 Concluded.

| | Evening Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort<br>Total Catch<br>Catch/Unit Effort | N.S. | | N.S. | | 612.6 $m^2$<br>11<br>0.018/$m^2$ | | | |
| | | | | | | | Means | |
| Species | $CPM^2$ x100 | % | $CPM^2$ x100 | % | $CPM^2$ x100 | % | $CPM^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | 0.16 | 9.1 | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | 1.47 | 81.8 | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | 0.16 | 9.1 | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 8-4 Summary of catches per effort of fish taken by various methods for Moose Lake (site 8-3), 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 122.5 m² | | N.S. | | 122.5 m² | | 122.5m² | |
| Total Catch | 0 | | | | 59 | | 29.5 | |
| Catch/Unit Effort | 0.00/m² | | | | 0.482/m² | | 0.241/m² | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | 45.71 | 94.9 | 23.86 | 94.9 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | 0.82 | 1.7 | 0.41 | 1.7 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | 1.63 | 3.4 | 0.82 | 3.4 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 8-5 Summary of catches per effort of fish taken by various methods for Moose Lake (site 8-3), 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 612.6 $m^2$ | | N.S. | | 612.6 $m^2$ | | 612.6$m^2$ | |
| Total Catch | 9 | | | | 48 | | 28.5 | |
| Catch/Unit Effort | 0.015/$m^2$ | | | | 0.078/$m^2$ | | 0.047/$m^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | 6.04 | 77.1 | 3.02 | 38.6 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | 0.49 | 33.3 | | | 0.16 | 2.1 | 0.33 | 17.7 |
| Ninespine stickleback | 0.65 | 44.4 | | | | | 0.33 | 22.2 |
| yellow perch | 0.33 | 22.2 | | | 1.63 | 20.8 | 0.98 | 21.5 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 8-6 Summary of catches per effort of fish taken by various methods for Moose Lake (site 8-4), 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 122.5 $m^2$ | | | | | | | |
| Total Catch | 0 | | N.S. | | N.S. | | | |
| Catch/Unit Effort | 0.00/$m^2$ | | | | | | | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 8-7 Summary of catches per effort of fish taken by various methods for Moose Lake (site 8-4), 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort<br>Total Catch<br>Catch/Unit Effort | 612.6 m$^2$<br>53<br>0.087/m$^2$ | | N.S. | | N.S. | | | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | 0.33 | 3.8 | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.65 | 7.6 | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | 0.65 | 7.6 | | | | | | |
| yellow perch | 4.41 | 50.9 | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | 2.61 | 30.2 | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 8-8 Summary of catches per effort of fish taken by various methods for Moose Lake (site 8-8), 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | N.S. | | N.S. | | 122.5 m$^2$ | | | |
| Total Catch | | | | | 268 | | | |
| Catch/Unit Effort | | | | | 2.188/m$^2$ | | | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | 217.14 | 99.2 | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | 1.63 | 0.8 | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

## 9.0 MURIEL LAKE

Eight sampling sites (numbers 9-1 to 9-8) were established on Muriel Lake (Figure 9-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Muriel Lake are presented in Table 9-1 (catch-per-unit-effort) and Table 9-2 (length frequencies).

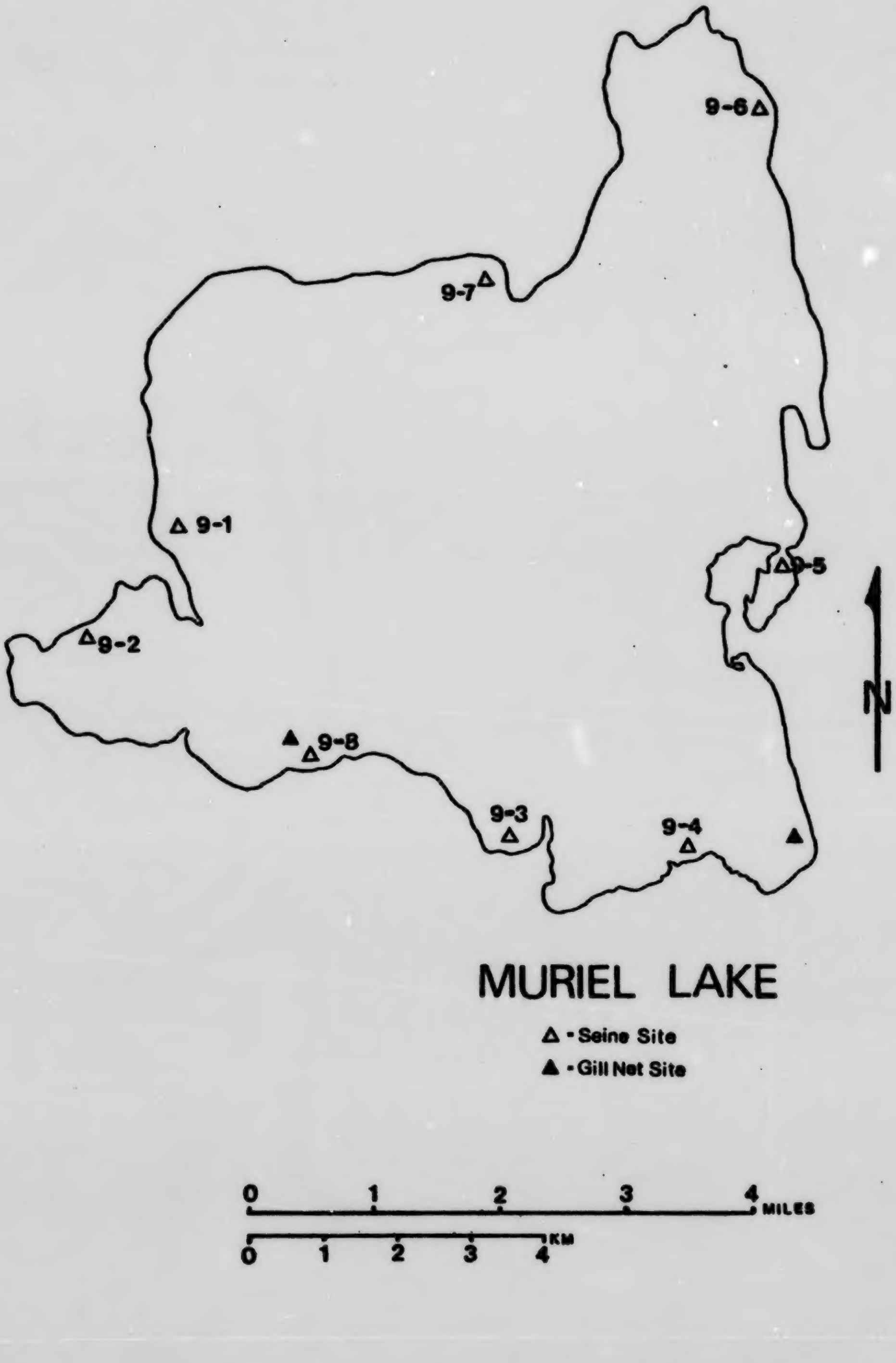

9-6
9-7
9-1
9-5
9-2
9-8
9-3
9-4
N
MURIEL LAKE
△ - Seine Site
▲ - Gill Net Site
0 1 2 3 4 MILES
0 1 2 3 4 KM

Figure 9-1 Map of Muriel Lake showing locations of sampling sites.

## LAKE SITE

**Site Number** 9-1

**Lake Name** Muriel Lake

**Location** See Figure 9-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-1.0m, 60m-2.0m, 90m-2.5m. |
| **Shoreline Features** | Park area has gentle slope. Elsewhere steep shoreline. |
| **Aquatic Vegetation** | None. |
| **Substrate Type** | Sand 90%. Gravel 10%. |

## SURFACE TEMPERATURE

| | | | |
|---|---|---|---|
| **Date** | May 7 | May 20 | Oct 10 |
| **Temperature** | 9°C | 13°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 7 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| May 20 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| Oct 10 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  | 1.22 |  | 2.45 | 1.84 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  | 0.16 | 0.08 |  |  | 0.82 | 0.41 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 0.24 |  |  | 0.12 | 6.12 |  |  | 3.06 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2$m^2$ | NS | 612.6$m^2$ | 918.9$m^2$ | 245.0$m^2$ | NS | 122.5$m^2$ | 183.8$m^2$ |
| Total Catch | 3 |  | 1 | 2 | 18 |  | 4 | 11 |
| Catch/Unit Effort | 0.002/$m^2$ |  | 0.002/$m^2$ | 0.002/$m^2$ | 0.074/$m^2$ |  | 0.033/$m^2$ | 0.059/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number 9-2

Lake Name Muriel Lake

Location See Figure 9-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-1.5m, 60m-2.25m, 90m-3.0m. |
| Shoreline Features | Bank 1m high. No slope. Shrubs and grasses. |
| Aquatic Vegetation | Emergent reeds and submergent vegetation. 70-75% cover of bulrush extending 20-30m off shore. |
| Substrate Type | Sand 90%. Gravel 10%. |

## SURFACE TEMPERATURE

| Date | May 7 | May 20 | Jul 12 | Oct 10 |
|---|---|---|---|---|
| Temperature | 9°C | 14°C | 19°C | 6°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 7 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| May 20 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| Jul 12 | Minnow seine | 0.5-1.0m |
| Oct 10 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 0.41 |  |  | 0.20 | 23.27 | 857.14 | 6.53 | 295.65 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.41 |  |  | 0.14 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 4.49 | 11.43 |  | 5.31 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1225.2m$^2$ | NS | 612.6m$^2$ | 918.9m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 5 |  | 0 | 2.5 | 69 | 1064 | 8 | 380.3 |
| Catch/Unit Effort | 0.004/m$^2$ |  | 0.00/m$^2$ | 0.003/m$^2$ | 0.282/m$^2$ | 8.686/m$^2$ | 0.065/m$^2$ | 2.329/m$^2$ |

NS = not sampled

### LAKE SITE

Site Number 9-3

Lake Name Muriel Lake

Location See Figure 9-1

### SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Shallow, gradual increase in depth from shoreline: 30m-0.75m, 60m-0.75m, 90m-1.5m. |
| Shoreline Features | Well-defined beach area. No true bank. |
| Aquatic Vegetation | Emergent and submergent vegetation. 5-10% bulrush extending 20m off shore. |
| Substrate Type | Sand 100%. |

### SURFACE TEMPERATURE

| Date | May 7 | May 20 | Jul 12 | Oct 10 |
|---|---|---|---|---|
| Temperature | 8.5°C | 17.5°C | 20°C | 6°C |

### METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 7 | Minnow seine | 0.5-1.0m |
| May 20 | Minnow seine | 0.5-1.0m |
| Jul 12 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| Oct 10 | Minnow seine | 0.5-1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  | 73.46 |  |  | 2.86 | 193.47 | 5.71 | 67.35 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  | 1.47 |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 3.67 | 1.63 |  | 1.77 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | NS | 612.6$m^2$ | NS | 612.6$m^2$ | 245.0$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 163.3$m^2$ |
| Total Catch |  | 459 |  | 459 | 16 | 239 | 7 | 87.3 |
| Catch/Unit Effort |  | 0.749/$m^2$ |  | 0.749/$m^2$ | 0.065/$m^2$ | 1.951/$m^2$ | 0.057/$m^2$ | 0.535/$m^2$ |

NS = not sampled

## LAKE SITE

Site Number 9-4

Lake Name Muriel Lake

Location See Figure 9-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-1.75m, 60m-3.0m, 90m-3.25m. |
| Shoreline Features | Bank with relatively steep slope. Grasses and shrubs. |
| Aquatic Vegetation | Emergent reeds and submergent vegetation near shore. |
| Substrate Type | Sand 90%. Rubble 10%. |

## SURFACE TEMPERATURE

| Date | May 7 | May 20 | Jul 12 | Oct 10 |
|---|---|---|---|---|
| Temperature | 10°C | 17.5°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 7 | Beach seine | 0.75-1.5m |
| | Minnow seine | 0.5-1.0m |
| May 20 | Beach seine | 0.75-1.5m |
| | Minnow seine | 0.5-1.0m |
| Jul 12 | Beach seine | 0.75-1.5m |
| | Minnow seine | 0.5-1.0m |
| Oct 10 | Beach seine | 0.75-1.5m |
| | Minnow seine | 0.5-1.0m |
| | Gillnet (15.2m:12.7cm) | |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | 0.08 | | | 0.03 | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 0.49 | 0.16 | 0.16 | 0.27 | 2.86 | 40.82 | 4.90 | 16.19 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | 0.16 | | 0.05 | 0.82 | 0.82 | | 0.55 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 0.08 | 6.69 | 0.16 | 2.31 | | 91.43 | | 30.48 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.82 | | | 0.27 | 11.84 | | | 3.95 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1225.2m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 816.8m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 18 | 43 | 2 | 21 | 38 | 163 | 6 | 69 |
| Catch/Unit Effort | 0.015/m$^2$ | 0.070/m$^2$ | 0.003/m$^2$ | 0.026/m$^2$ | 0.155/m$^2$ | 1.331/m$^2$ | 0.049/m$^2$ | 0.423/m$^2$ |

## LAKE SITE

Site Number 9-5

Lake Name Muriel Lake

Location See Figure 9-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-0.75m, 60m-1.25m, 90m-2.75m. |
| Shoreline Features | Gentle sloping bank. Grasses and shrubs. |
| Aquatic Vegetation | Emergent reeds and submergent vegetation. 50-100% cover of bulrushes near shore. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 7 | May 20 | Jul 12 | Oct 10 |
|---|---|---|---|---|
| Temperature | 10.5°C | 16.5°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 7 | Minnow seines | 0.5-1.0m |
| May 20 | Minnow seines | 0.5-1.0m |
| Jul 12 | Minnow seines | 0.5-1.0m |
| Oct 10 | Minnow seines | 0.5-1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  | 0.41 |  |  | 0.14 |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  | 381.22 | 163.27 | 427.76 | 324.08 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  | 17.14 |  |  | 5.71 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 6.94 |  | 2.45 | 3.13 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | NS | NS | NS |  | 245.0m²<br>994<br>4.057/m² | 122.5m²<br>200<br>1.633/m² | 122.5m²<br>527<br>4.302/m² | 163.3m²<br>573.7<br>3.513/m² |

NS = not sampled

## LAKE SITE

Site Number 9-6

Lake Name Muriel Lake

Location See Figure 9-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-2m, 60m-2.5m, 90m-2.75m. |
| Shoreline Features | Bank 2-3m high. Shrubs, grasses, trees. |
| Aquatic Vegetation | 50% submergent vegetation near shore. |
| Substrate Type | Sand 90%. Rubble 10%. |

## SURFACE TEMPERATURE

| Date | May 7 | May 20 | Jul 12 | Oct 10 |
|---|---|---|---|---|
| Temperature | 7°C | 14°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 7 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| May 20 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| Jul 12 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| Oct 10 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  | 0.16 |  | 0.05 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 0.49 | 4.90 | 0.49 | 1.96 | 6.94 | 17.14 | 75.10 | 33.06 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback | 0.16 |  |  | 0.05 | 5.71 |  | 1.63 | 2.45 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  | 65.62 |  | 21.87 |  | 8.98 |  | 2.99 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 1.14 |  |  | 0.38 | 17.96 | 3.27 |  | 7.08 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 612.6m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 11 | 433 | 3 | 149 | 75 | 36 | 94 | 68.3 |
| Catch/Unit Effort | 0.018/m$^2$ | 0.707/m$^2$ | 0.005/m$^2$ | 0.243/m$^2$ | 0.306/m$^2$ | 0.294/m$^2$ | 0.767/m$^2$ | 0.419/m$^2$ |

## LAKE SITE

Site Number 9-7

Lake Name Muriel Lake

Location See Figure 9-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Moderate increase in depth from shoreline: 30m-2m, 60m-3m, 90m-5m. |
| Shoreline Features | Well-defined beach area. No true bank. |
| Aquatic Vegetation | 10% submergent vegetation. |
| Substrate Type | Sand 90%. Gravel 10%. |

## SURFACE TEMPERATURE

| Date | May 7 | May 20 | Jul 12 | Oct 10 |
|---|---|---|---|---|
| Temperature | 10°C | 15°C | 20°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 7 | Minnow seine | 0.5-1.0m |
| May 20 | Minnow seine | 0.5-1.0m |
| Jul 12 | Beach seine | 0.75-1.5m |
| | Minnow seine | 0.5-1.0m |
| Oct 10 | Beach seine | 0.75-1.5m |
| | Minnow seine | 0.5-1.0m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | 1.63 | | 0.82 | 9.39 | 202.45 | 3.27 | 71.70 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | 0.33 | | 0.17 | | 0.82 | | 0.27 |
| Brook stickleback | | | | | 0.41 | | | 0.14 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | 1.80 | 0.65 | 1.23 | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | 3.43 | | 1.72 | 37.55 | 39.18 | 0.82 | 25.85 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | | 612.6m² | 612.6m² | 612.6m² | 245.0m² | 122.5m² | 122.5m² | 163.3m² |
| Total Catch | NS | 44 | 4 | 24 | 116 | 297 | 5 | 139.3 |
| Catch/Unit Effort | | 0.072/m² | 0.007/m² | 0.039/m² | 0.474/m² | 2.425/m² | 0.041/m² | 0.853/m² |

NS = not sampled

**LAKE SITE**

**Site Number** 9-8

**Lake Name** Muriel Lake

**Location** See Figure 9-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-0.75m, 60m-1.0m, 90m-1.5m. |
| **Shoreline Features** | Well-defined beach. No true bank. |
| **Aquatic Vegetation** | Submergent reeds approximately 20m from shoreline. |
| **Substrate Type** | Sand 100%. |

**SURFACE TEMPERATURE**

| **Date** | **May 20** | **Jul 12** | **Oct 10** |
|---|---|---|---|
| **Temperature** | 15°C | 20°C | 6.5°C |

**METHODS**

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| May 7 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| May 20 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| Jul 12 | Beach seine<br>Minnow seine | 0.75-1.5m<br>0.5-1.0m |
| Oct 10 | Beach seine<br>Minnow seine<br>Gillnet (15.2m:12.7cm) | 0.75-1.5m<br>0.5-1.0m |

FISH CAPTURES

| | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| Species | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | 0.33 | | | 0.11 | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | 36.24 | 0.49 | 12.24 | | 52.24 | 16.33 | 22.86 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | 0.82 | 0.27 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | 14.69 | | 4.89 | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | 9.80 | | 3.27 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ |
| Total Catch | 2 | 312 | 3 | 105.7 | 0 | 76 | 21 | 32.3 |
| Catch/Unit Effort | 0.003/m$^2$ | 0.509/m$^2$ | 0.005/m$^2$ | 0.173/m$^2$ | 0.00/m$^2$ | 0.620/m$^2$ | 0.171/m$^2$ | 0.264/m$^2$ |

Table 9-1 Summary of catches per effort of fish taken by various methods for Muriel Lake, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

|  | Minnow Seine |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring |  | Summer |  | Fall |  | Total Mean |  |
| Effort | 1837.8 $m^2$ |  | 847.6 $m^2$ |  | 980.2 $m^2$ |  | 1225.2 $m^2$ |  |
| Total Catch | 1329 |  | 2075 |  | 672 |  | 1358.7 |  |
| Catch/Unit Effort | 0.723/$m^2$ |  | 2.419/$m^2$ |  | 0.686/$m^2$ |  | 1.109/$m^2$ |  |
|  |  |  |  |  |  |  | Means |  |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub | 0.54 | 0.7 |  |  |  |  | 0.18 | 0.2 |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 57.68 | 78.6 | 218.04 | 90.1 | 67.74 | 98.8 | 114.49 | 89.2 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  | 0.12 | <0.1 |  |  | 0.04 | <0.1 |
| Brook stickleback | 1.09 | 1.5 | 0.12 | <0.1 | 0.31 | 0.5 | 0.51 | 0.7 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| yellow perch | 2.28 | 3.1 | 14.34 | 5.9 | 0.10 | 0.1 | 5.57 | 3.0 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 11.81 | 16.1 | 9.33 | 3.9 | 0.41 | 0.6 | 7.18 | 6.9 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |

continued

Table 9-1 Continued.

| | Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 4900.8 m² | | 3063.0 m² | | 3674.6 m² | | 3879.8 m² | |
| Total Catch | 39 | | 1291 | | 13 | | 447.7 | |
| Catch/Unit Effort | 0.008/m² | | 0.421/m² | | 0.004/m² | | 0.115/m² | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | 0.04 | 5.0 | | | | | 0.01 | 1.7 |
| Lake cisco | | | | | | | | |
| Northern pike | | | 0.33 | 0.8 | | | 0.11 | 0.3 |
| Lake chub | 0.02 | 2.5 | | | | | 0.01 | 0.8 |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 0.29 | 36.3 | 23.28 | 54.8 | 0.19 | 54.3 | 7.92 | 48.5 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | 0.07 | 0.2 | | | 0.02 | 0.1 |
| Brook stickleback | 0.02 | 2.5 | 0.03 | 0.1 | | | 0.02 | 0.9 |
| Ninespine stickleback | | | | | | | | |
| yellow perch | 0.02 | 2.5 | 18.05 | 42.5 | 0.16 | 45.7 | 6.08 | 30.2 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.41 | 51.3 | 0.69 | 1.6 | | | 0.37 | 17.6 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

continued

Table 9-1 Concluded.

| | Gillnet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort<br>Total Catch<br>Catch/Unit Effort | N.S. | | N.S. | | 47 hr.<br>13<br>0.277/hr. | | | |
| | | | | | | | Means | |
| Species | CPM[2] x100 | % | CPM[2] x100 | % | CPM[2] x100 | % | CPM[2] x100 | % |
| Lake whitefish | | | | | 14.89 | 53.9 | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | 12.77 | 46.1 | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 9-2 Summary of length-frequency data for fish captured in Muriel Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentage.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | 7 | | | | | 1 | 4 | | | | | | | | | | 50 | 24 | |
| 0-25 | | | | | | | | | | | | | | | | | | | 24.0 | | |
| 26-50 | | | | | | | | | | | | | | | | | | | 60.0 | 41.7 | |
| 51-75 | | | | | | | | | | | | | | | | | | | 12.0 | 41.7 | |
| 76-100 | | | | | | | | | | | | | | | | | | | 4.0 | 16.7 | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | 42.9 | | | | | | | | | | | | | | | | | | |
| 276-300 | | | 42.9 | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | 14.3 | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 25.0 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 25.0 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 25.0 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 25.0 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | 100.0 | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 9-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | | | | | 2 | | |
| 0-25 | | | | | | | | | | | | | | | | | | | 50.0 | | |
| 26-50 | | | | | | | | | | | | | | | | | | | 50.0 | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 9-2 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 5 | 17 | | | | | 6 | 5 | | | | | | | | | | |
| 0-25 | | | | 20.0 | | | | | | 50.0 | | | | | | | | | | | |
| 26-50 | | | | 80.0 | 5.9 | | | | | 50.0 | 100.0 | | | | | | | | | | |
| 51-75 | | | | | 47.1 | | | | | | | | | | | | | | | | |
| 76-100 | | | | | 23.5 | | | | | | | | | | | | | | | | |
| 101-125 | | | | | 5.9 | | | | | | | | | | | | | | | | |
| 126-150 | | | | | 17.7 | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## 10.0 TUCKER LAKE

Six sampling (numbers 10-1 to 10-6) were established on Tucker Lake (Figure 10-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Tucker Lake are presented in Table 10-1 (catch-per-unit-effort) and Table 10-2 (length frequencies).

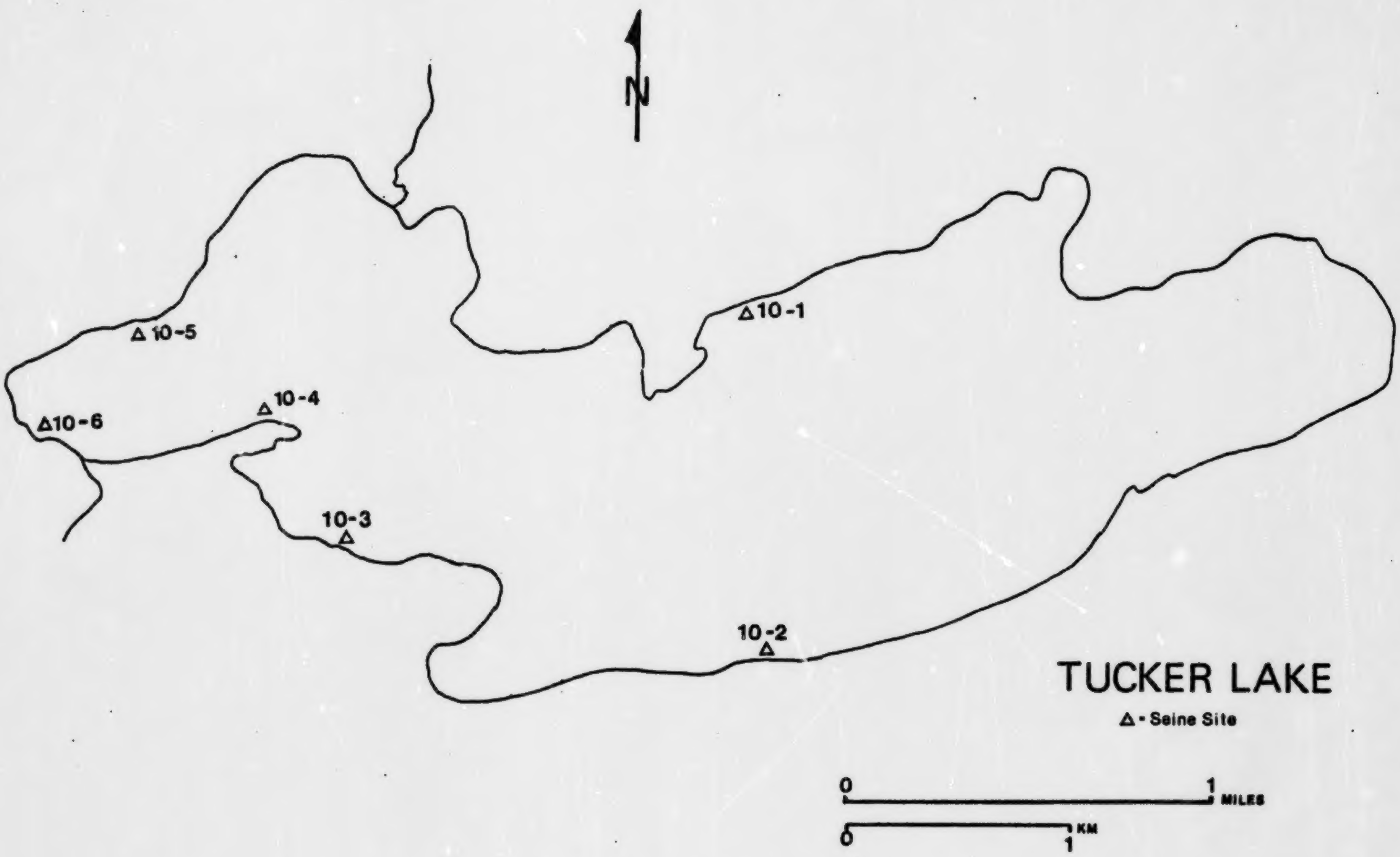

N
Δ10-1
10-2 Δ
10-3 Δ
Δ10-4
Δ10-5
Δ10-6
TUCKER LAKE
Δ - Seine Site
0
1
MILES
0
1
KM

Figure 10-1. Map of Tucker Lake showing sampling sites.

## LAKE SITE

| | |
|---|---|
| Site Number | 10-1 |
| Lake Name | Tucker Lake |
| Location | See Figure 10-1 |

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | High, stable bank. Willows, dogwood, birch, deadfall. |
| Aquatic Vegetation | Emergent pond lily and bulrush. Submergent vegetation also present. |
| Substrate Type | Sand 90%. Silt/mud 10%. |

## SURFACE TEMPERATURE

| | | | | |
|---|---|---|---|---|
| Date | May 4 | May 20 | Jul 18 | Oct 11 |
| Temperature | 9°C | 17°C | 23°C | 6°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Beach seine<br>Minnow seine | 0.7-1.0m<br>0.5-0.75m |
| May 20 | Beach seine<br>Minnow seine | 0.7-1.0m<br>0.5-0.75m |
| Jul 18 | Minnow seine | 0.5-0.75m |
| Oct 11 | Minnow seine | 0.5-0.75m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.65 | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 1.14 | | | | | 15.51 | 0.82 | 5.44 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | 0.41 | 20.41 | | 6.94 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m$^2$ | NS | NS | 612.6m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 11 | | | 11 | 1 | 44 | 1 | 15.3 |
| Catch/Unit Effort | 0.018/m$^2$ | | | 0.018/m$^2$ | 0.004/m$^2$ | 0.359/m$^2$ | 0.008/m$^2$ | 0.094/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 10-2

Lake Name Tucker Lake

Location See Figure 10-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Unstable bank. Dogwood and spruce. |
| Aquatic Vegetation | 50% emergent bulrush. Submergent vegetation (coontail) and filamentous green algae. |
| Substrate Type | Gravel 95%. Sand 5%. |

## SURFACE TEMPERATURE

| Date | May 4 | May 20 | Jul 18 | Oct 11 |
|---|---|---|---|---|
| Temperature | 8°C | 14.5°C | 23°C | 6°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Beach seine<br>Minnow seine | 1.0m<br>0.5-0.8m |
| May 20 | Beach seine<br>Minnow seine | 1.0m<br>0.5-0.8m |
| Jul 18 | Minnow seine | 0.5-0.8m |
| Oct 11 | Minnow seine | 0.5-0.8m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.10 | | | | 0.41 | | | 0.14 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.10 | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 0.10 | | | | | 4.90 | 1.63 | 2.18 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | 0.82 | 0.27 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 1021.0$m^2$<br>3<br>0.003/$m^2$ | NS | NS | 1021.0$m^2$<br>3<br>0.003/$m^2$ | 245.0$m^2$<br>1<br>0.004/$m^2$ | 40.8$m^2$<br>2<br>0.049/$m^2$ | 122.5$m^2$<br>3<br>0.025/$m^2$ | 136.1$m^2$<br>2<br>0.015/$m^2$ |

NS = not sampled

## LAKE SITE

|  |  |
|---|---|
| Site Number | 10-3 |
| Lake Name | Tucker Lake |
| Location | See Figure 10-1 |

## SITE CHARACTERISTICS

|  |  |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-2.0m, 60m-5.0m, 90m-7.0m. |
| Shoreline Features | Stable bank. Willows, aspen, and dogwood. |
| Aquatic Vegetation | Sparse submergent vegetation. Phytoplankton abundant. |
| Substrate Type | Sand 95%. Silt/mud 5%. |

## SURFACE TEMPERATURE

|  |  |  |  |
|---|---|---|---|
| Date | May 4 | May 20 | Oct 11 |
| Temperature | 9°C | 18°C | 6°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Beach seine<br>Minnow seine | 0.7-1.2m<br>0.4-0.7m |
| May 20 | Beach seine<br>Minnow seine | 0.7-1.2m<br>0.4-0.7m |
| Jul 18 | Minnow seine | 0.4-0.7m |
| Oct 11 | Beach seine<br>Minnow seine | 0.7-1.2m<br>0.4-0.7m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 0.49 | 0.25 | 1.63 | | 2.45 | 1.36 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 0.16 | | 1.31 | 0.74 | 45.05 | | | 15.02 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | 0.33 | 0.11 | | 36.76 | | 12.25 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m$^2$ | NS | 612.6m$^2$ | 612.6m$^2$ | 306.3m$^2$ | 40.8m$^2$ | 40.8m$^2$ | 129.3m$^2$ |
| Total Catch | 1 | | 13 | 7 | 143 | 15 | 1 | 53 |
| Catch/Unit Effort | 0.002/m$^2$ | | 0.021/m$^2$ | 0.011/m$^2$ | 0.467/m$^2$ | 0.368/m$^2$ | 0.025/m$^2$ | 0.410/m$^2$ |

NS = not sampled

### LAKE SITE

Site Number 10-4

Lake Name Tucker Lake

Location See Figure 10-1

### SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-2.0m, 60m-5.0m, 90m-7.0m. |
| Shoreline Features | Stable bank. Willows, dogwood, aspen, poplar, deadfall. |
| Aquatic Vegetation | 25% emergent bulrush 10-15m off shore. Submergent vegetation also present. |
| Substrate Type | Sand 100%. |

### SURFACE TEMPERATURE

| Date | May 4 | May 20 | Jul 18 | Oct 11 |
|---|---|---|---|---|
| Temperature | 9°C | 16°C | 23°C | 6°C |

### METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Beach seine<br>Minnow seine | 0.7-1.5m<br>0.25-0.75m |
| May 20 | Beach seine<br>Minnow seine | 0.7-1.5m<br>0.25-0.75m |
| Jul 18 | Minnow seine | 0.25-0.75m |
| Oct 11 | Beach seine<br>Minnow seine | 0.7-1.5m<br>0.25-0.75m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.10 | | 0.16 | 0.13 | | | 1.63 | 0.54 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | 0.49 | 0.25 | | | | |
| Brook stickleback | | | | | | | 0.82 | 0.27 |
| Ninespine stickleback | | | | | 2.04 | | | 0.68 |
| Yellow perch | | | 0.16 | 0.08 | | 2.45 | | 0.82 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | 0.41 | 79.18 | 1.63 | 27.07 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 1021.0m² | NS | 612.6m² | 816.8m² | 245.0m² | 122.5m² | 122.5m² | 163.3m² |
| Total Catch | 1 | | 5 | 3 | 6 | 100 | 5 | 37 |
| Catch/Unit Effort | 0.001/m² | | 0.008/m² | 0.004/m² | 0.025/m² | 0.816/m² | 0.041/m² | 0.227/m² |

NS = not sampled

## LAKE SITE

**Site Number** 10-5

**Lake Name** Tucker Lake

**Location** See Figure 10-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth. |
| **Shoreline Features** | Stable bank. Willows, dogwood, poplar, and deadfall. Sedge near shore. |
| **Aquatic Vegetation** | None. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| **Date** | May 4 | May 20 | Jul 18 | Oct 11 |
|---|---|---|---|---|
| **Temperature** | 9°C | 17°C | 23°C | 6°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Beach seine<br>Minnow seine | 0.5-1.0m<br>0.25-0.5m |
| May 20 | Beach seine<br>Minnow seine | 0.5-1.0m<br>0.25-0.5m |
| Jul 18 | Minnow seine | 0.25-0.5m |
| Oct 11 | Beach seine<br>Minnow seine | 0.5-1.0m<br>0.25-0.5m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | 0.49 | 0.25 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | 0.16 | 0.08 | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | 0.98 | 0.49 | 965.31 | 5.71 | | 323.67 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | 0.16 | 0.08 | | 27.76 | | 9.25 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 306.3m$^2$ | NS | 612.6m$^2$ | 459.5m$^2$ | 245.0m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 163.3m$^2$ |
| Total Catch | 0 | | 11 | 5.5 | 2365 | 41 | 0 | 802 |
| Catch/Unit Effort | 0.00/m$^2$ | | 0.018/m$^2$ | 0.012/m$^2$ | 9.653/m$^2$ | 0.335/m$^2$ | 0.00/m$^2$ | 4.911/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 10-6

Lake Name Tucker Lake

Location See Figure 10-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth. |
| Shoreline Features | Stable bank. Willows, dogwood, deadfall. Sedge near shore. |
| Aquatic Vegetation | Bulrush and pond lilies emergent. Submergent vegetation also present. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 4 | May 20 | Jul 18 | Oct 11 |
|---|---|---|---|---|
| Temperature | 9°C | 14°C | 23°C | 6°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| May 4 | Beach seine<br>Minnow seine | 0.5-1.1m<br>0.25-0.5m |
| May 20 | Beach seine<br>Minnow seine | 0.5-1.1m<br>0.25-0.5m |
| Jul 18 | Minnow seine | 0.25-0.5m |
| Oct 11 | Minnow seine | 0.25-0.5m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  | 0.82 | 0.27 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  | 0.82 |  |  | 0.27 |
| Yellow perch |  |  |  |  | 45.31 | 2.45 |  | 15.92 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  | 15.51 |  | 5.17 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 408.4$m^2$ |  |  | 408.4$m^2$ | 245.0$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 163.3$m^2$ |
| Total Catch | 0 | NS | NS | 0 | 133 | 22 | 1 | 45.3 |
| Catch/Unit Effort | 0.00/$m^2$ |  |  | 0.00/$m^2$ | 0.461/$m^2$ | 0.179/$m^2$ | 0.008/$m^2$ | 0.278/$m^2$ |

NS = not sampled

Table 10-1 Summary of catches per effort of fish taken by various methods for Tucker Lake, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 1531.5 m$^2$ | | 571.8 m$^2$ | | 653.4 m$^2$ | | 918.9 m$^2$ | |
| Total Catch | 2629 | | 224 | | 11 | | 954.7 | |
| Catch/Unit Effort | 1.717/m$^2$ | | 0.392/m$^2$ | | 0.017/m$^2$ | | 1.039/m$^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.39 | 0.2 | | | 0.61 | 36.1 | 0.33 | 12.1 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | 0.16 | 9.5 | 0.05 | 3.2 |
| Ninespine stickleback | 0.46 | 0.3 | | | | | 0.15 | 0.1 |
| yellow perch | 170.68 | 99.4 | 5.95 | 15.2 | 0.46 | 27.2 | 59.03 | 47.3 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.13 | 0.1 | 33.23 | 84.8 | 0.46 | 27.2 | 11.27 | 37.4 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Continued

Table 10-2 Concluded.

| Species | Beach Seine<br>Spring<br>CPM² x100 | <br><br>% | <br>Summer<br>CPM² x100 | <br><br>% | <br>Fall<br>CPM² x100 | <br><br>% | <br>Total Mean<br>CPM² x100 | <br>Means<br>% |
|---|---|---|---|---|---|---|---|---|
| Effort | 4594.5 m² | | N.S. | | 1837.8 m² | | 3216.2 m² | |
| Total Catch | 16 | | | | 29 | | 22.5 | |
| Catch/Unit Effort | 0.004/m² | | | | 0.016/m² | | 0.007/m² | |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.13 | 37.5 | | | 0.38 | 24.1 | 0.26 | 30.8 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.02 | 6.3 | | | | | 0.01 | 3.2 |
| Burbot | | | | | 0.16 | 10.3 | 0.08 | 5.5 |
| Brook stickleback | | | | | 0.05 | 3.5 | 0.03 | 1.7 |
| Ninespine stickleback | | | | | | | | |
| yellow perch | 0.20 | 56.3 | | | 0.82 | 51.7 | 0.51 | 54.0 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | 0.16 | 10.3 | 0.08 | 5.2 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 10-2 Summary of length-frequency data for fish captured in Tucker Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentage.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 4 | 13 | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | 25.0 | 23.1 | | | | | | | | | | | | | |
| 151-175 | | | | | | | 50.0 | 15.4 | | | | | | | | | | | | | |
| 176-200 | | | | | | | 25.0 | 15.4 | | | | | | | | | | | | | |
| 201-225 | | | | | | | | 23.1 | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | 15.4 | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | 7.7 | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 10-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | 1 | | | 3 | | 1 | 1 | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | 100.0 | 100.0 | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | 33.3 | | | | |
| 176-200 | | | | | | | | | | | | | | 100.0 | | | 66.7 | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 10-2 Concluded.

| | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 12 | 16 | | | | | 11 | | | | | | | | | | | |
| 0-25 | | | | | | | | | | 45.5 | | | | | | | | | | | |
| 26-50 | | | | 33.3 | | | | | | 54.5 | | | | | | | | | | | |
| 51-75 | | | | 16.7 | 68.8 | | | | | | | | | | | | | | | | |
| 76-100 | | | | 41.7 | 12.5 | | | | | | | | | | | | | | | | |
| 101-125 | | | | 8.3 | 12.5 | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | 6.3 | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## 11.0 WOLF LAKE

Nine sampling sites (numbers 11-1 to 11-9) were established on Wolf Lake (Figure 11-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Lake Site sheets. Data summaries for Wolf Lake are presented in Table 11-1 (catch-per-unit-effort) and Table 8-2 (length frequencies). Supplementary data for evening seining at sites 11-1 and 11-5 are presented in Tables 11-3 to 11-5.

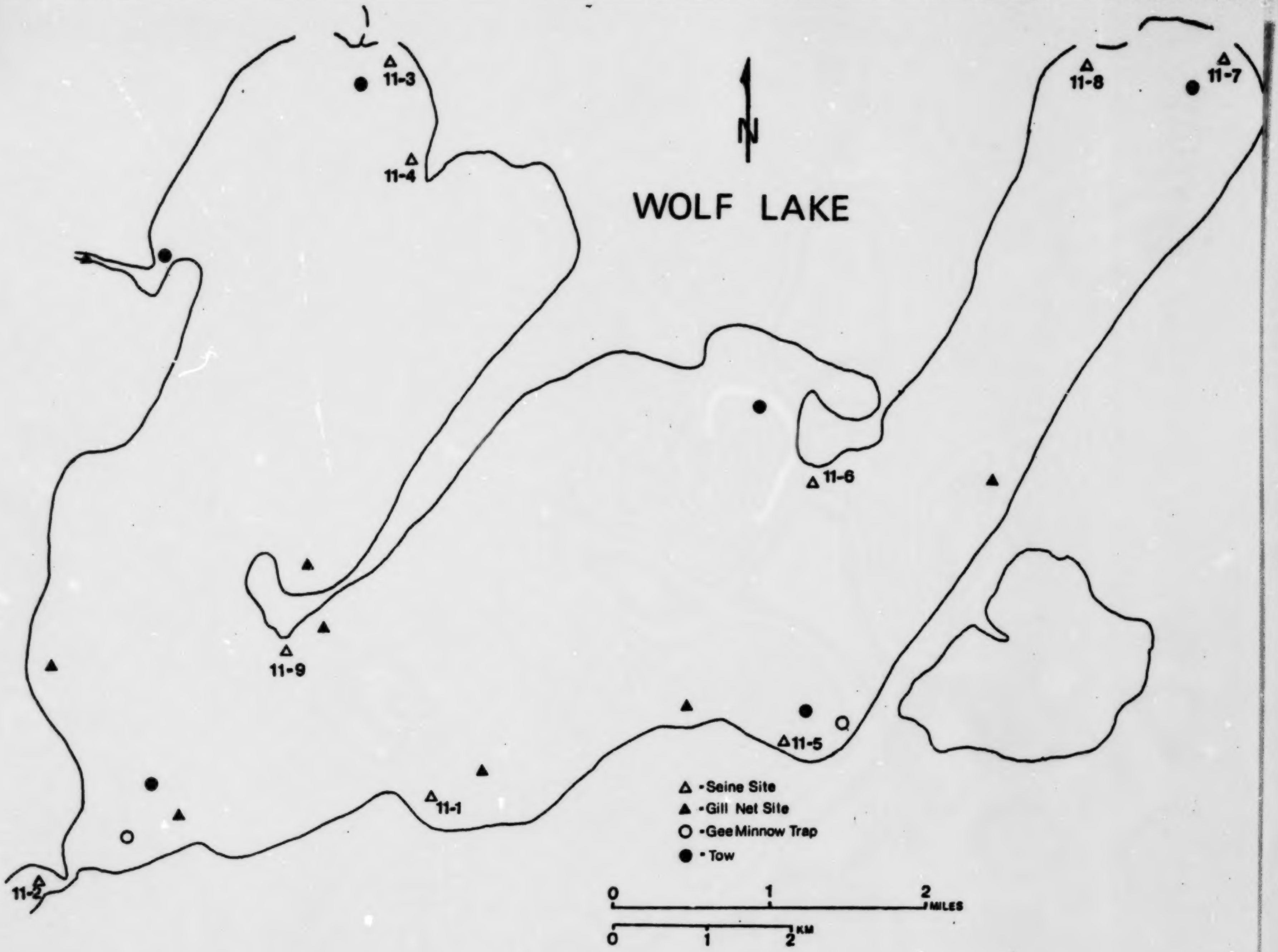

WOLF LAKE
N
11-3
11-4
11-8
11-7
11-6
11-9
11-5
11-1
11-2
△ •Seine Site
▲ •Gill Net Site
○ •Gee Minnow Trap
● •Tow
0
1
2
MILES
0
1
2
KM

Figure 11-1 Map of Wolf Lake showing locations of sampling sites.

## LAKE SITE

**Site Number** 11-1

**Lake Name** Wolf Lake

**Location** See Figure 11-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-0.5m, 60m-1.0m, 90m-1.75m. |
| **Shoreline Features** | Well-defined bank. 45° slope. |
| **Aquatic Vegetation** | Emergent reeds and submergent vegetation. Floating algal mats. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| **Date** | May 4-6 | May 11-12 | May 26 | Oct 7-9 |
|---|---|---|---|---|
| **Temperature** | 7°C | 10.5°C | 17°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Spring | Minnow seine<br>Beach seine | 0.5m<br>1.0m |
| May 12 | ¶Evening seining | See Table 11-3 |
| Fall | Minnow seine<br>Beach seine | 0.5m<br>1.0m |
| Oct 14 | ¶Evening seining | See Table 11-3 |

¶Supplementary data

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 3.67 | | | 1.84 | 10.88 | | 40.82 | 25.85 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 3.67 | | 2.61 | 3.14 | | | | |
| Burbot | | | 0.16 | 0.08 | | | | |
| Brook stickleback | 0.08 | | | 0.04 | | | | |
| Ninespine stickleback | | | | | 0.27 | | | 0.14 |
| Yellow perch | 21.63 | | 80.48 | 51.06 | 3.54 | | | 1.77 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.78 | | | 0.39 | 2.99 | | 8.10 | 5.58 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 2450.4m² | NS | 612.6m² | 1531.5m² | 367.6m² | NS | 122.5m² | 245.0m² |
| Total Catch | 731 | | 510 | 620.5 | 65 | | 60 | 62.5 |
| Catch/Unit Effort | 0.298/m² | | 0.833/m² | 0.405/m² | 0.177/m² | | 0.489/m² | 0.255/m² |

NS = not sampled

## LAKE SITE

**Site Number** 11-2

**Lake Name** Wolf Lake

**Location** See Figure 11-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-3.5m, 60m 4.5m, 90m-5.0m. |
| **Shoreline Features** | Gentle sloping bank. Grasses, shrubs, trees. |
| **Aquatic Vegetation** | Emergent reeds, pond lilies. Submergent vegetation. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| **Date** | May 4-6 | May 11-12 | May 26 | Oct 7-9 |
|---|---|---|---|---|
| **Temperature** | 9°C | 10.5°C | 17.5°C | 9°C |

## METHODS

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| Spring | Minnow seine | 0.25-1.0m |
| | Beach seine | 3.0m |
| May 27 | ¶Three-minute tows | See Table 11-1 |
| Fall | Minnow seine | 0.25-1.0m |
| | Beach seine | 3.0m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 8.49 |  |  | 4.25 | 21.49 |  | 67.76 | 44.63 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback | 0.11 |  |  | 0.05 |  |  |  |  |
| Ninespine stickleback | 0.05 |  |  | 0.03 | 0.27 |  |  | 0.14 |
| Yellow perch | 1.96 |  |  | 0.98 |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 0.27 |  |  | 0.14 | 1.63 |  |  | 0.82 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1837.8m$^2$ | NS | 612.6m$^2$ | 1225.2m$^2$ | 367.6m$^2$ | NS | 122.5m$^2$ | 245.0m$^2$ |
| Total Catch | 200 |  | 0 | 100 | 86 |  | 83 | 84.5 |
| Catch/Unit Effort | 0.109/m$^2$ |  | 0.00/m$^2$ | 0.082/m$^2$ | 0.234/m$^2$ |  | 0.678/m$^2$ | 0.345/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 11-3
Lake Name Wolf Lake
Location See Figure 11-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Moderate increase in depth from shoreline: 30m-6.5m, 60m-9.5m, 90m-10m. |
| Shoreline Features | Gentle sloping bank. Grasses, shrubs, trees. Shallow beach area for approximately 15m. |
| Aquatic Vegetation | Submergent vegetation 20m from shoreline. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 4-6 | May 11-12 | May 26 | Jul 11 | Oct 7-9 |
|---|---|---|---|---|---|
| Temperature | 9°C | 10.5°C | 17.5°C | 20°C | 9°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Spring | Minnow seine | 1.0m |
| | Beach seine | 3.25m |
| May 27 | ¶Three-minute tows | See Table 11-1 |
| Summer | Minnow seine | 1.0m |
| | Beach seine | 3.25m |
| Fall | Minnow seine | 1.0m |
| | Beach seine | 3.25m |

¶Supplementary data

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 0.16 |  |  | 0.05 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  | 5.06 |  | 1.69 | 0.27 |  |  | 0.09 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 0.16 |  |  | 0.05 |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback | 0.05 |  |  | 0.02 |  |  |  |  |
| Ninespine stickleback | 0.11 |  |  | 0.04 |  |  |  |  |
| Yellow perch |  | 556.64 |  | 185.55 |  |  | 0.82 | 0.27 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 0.65 |  |  | 0.22 | 8.43 | 3.27 |  | 3.90 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1837.8$m^2$ | 612.6$m^2$ | 612.6$m^2$ | 1021.0$m^2$ | 367.6$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 204.2$m^2$ |
| Total Catch | 21 | 3441 | 0 | 1154 | 32 | 4 | 1 | 12.3 |
| Catch/Unit Effort | 0.011/$m^2$ | 5.617/$m^2$ | 0.00/$m^2$ | 1.130/$m^2$ | 0.087/$m^2$ | 0.033/$m^2$ | 0.008/$m^2$ | 0.060/$m^2$ |

**LAKE SITE**

Site Number 11-4

Lake Name Wolf Lake

Location See Figure 11-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-0.5m, 60m-1.0m, 90m-1.25m |
| Shoreline Features | Bank 1 to 2m high. No slope. |
| Aquatic Vegetation | Emergent reeds. Submergent vegetation. |
| Substrate Type | Sand 100%. |

**SURFACE TEMPERATURE**

| Date | May 4-6 | May 11-12 | May 26 | Jul 11 | Oct 7-9 |
|---|---|---|---|---|---|
| Temperature | 11°C | 13°C | 18.5°C | 20°C | 9°C |

**METHODS**

| Date | Method | Depth of Set |
|---|---|---|
| Spring | Minnow seine | 0.5m |
| | Beach seine | 0.75m |
| May 27 | ¶Three-minute tows | See Table 11-1 |
| Summer | Minnow seine | 0.5m |
| | Beach seine | 0.75m |
| Fall | Minnow seine | 0.5m |

¶Supplementary data

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 2.12 | | | 1.06 | 281.83 | 7.35 | 134.69 | 141.29 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | 2.61 | | 1.30 | | 440.82 | 1.63 | 147.48 |
| Burbot | 0.16 | | | 0.08 | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | 0.16 | | | 0.08 | | | | |
| Yellow perch | | 11.59 | | 5.79 | | 367.35 | | 122.45 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 0.98 | | | 0.49 | 5.71 | | 9.80 | 5.17 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 612.6m$^2$ | 612.6m$^2$ | NS | 612.6m$^2$ | 367.6m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 204.2m$^2$ |
| Total Catch | 21 | 87 | | 54 | 1057 | 999 | 179 | 745 |
| Catch/Unit Effort | 0.034/m$^2$ | 0.142/m$^2$ | | 0.088/m$^2$ | 2.875/m$^2$ | 8.155/m$^2$ | 1.461/m$^2$ | 3.648/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 11-5

Lake Name Wolf Lake

Location See Figure 11-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline:<br>30m-1.5m, 60m-2.5m, 90m-3.0m. |
| Shoreline Features | Gravel shoreline. Shrubs. |
| Aquatic Vegetation | Submergent vegetation 15m from shoreline. |
| Substrate Type | Sand 90%. Rubble 10%. |

## SURFACE TEMPERATURE

| Date | May 4-6 | May 11-12 | May 26 | Jul 11 | Oct 7-9 |
|---|---|---|---|---|---|
| Temperature | 6.5°C | 12.5°C | 13°C | 18°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Spring | Minnow seine | 1.0m |
| | Beach seine | 1.5m |
| May 12 | ¶Evening seining | See Tables 11-4, 11-5 |
| May 27 | ¶Three-minute tows | See Table 11-1 |
| Summer | Minnow seine | 1.0m |
| | Beach seine | 1.5m |
| Fall | Minnow seine | 1.0m |
| | Beach seine | 1.5m |
| Oct 14 | ¶Evening seining | See Tables 11-4, 11-5 |

¶ Supplementary data

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  | 0.16 | 0.05 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  | 0.16 |  | 0.05 | 1.09 | 1.63 |  | 0.91 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  | 0.16 | 0.05 |  |  |  |  |
| Burbot |  |  |  |  |  | 0.82 |  | 0.27 |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  | 0.82 |  | 0.27 |
| Yellow perch | 0.44 | 12.90 | 15.67 | 9.67 | 0.54 | 3.27 | 1.63 | 1.81 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  | 2.18 | 1.63 |  | 1.24 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 1837.8m² | 612.6m² | 612.6m² | 1021.0m² | 367.6m² | 122.5m² | 122.5m² | 204.2m² |
| Total Catch | 8 | 80 | 98 | 62 | 14 | 10 | 3 | 9 |
| Catch/Unit Effort | 0.004/m² | 0.131/m² | 0.160/m² | 0.061/m² | 0.038/m² | 0.082/m² | 0.016/m² | 0.044/m² |

## LAKE SITE

**Site Number** Site 11-6

**Lake Name** Wolf Lake

**Location** See Figure 11-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-0.5m, 60m-0.5m, 90m-0.5m. |
| **Shoreline Features** | Bank 2 to 3m high. No slope. Grasses, shrubs, trees. |
| **Aquatic Vegetation** | 75-100% cover of emergent reeds and submergent vegetation for 10-20m off shore. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| | | | | |
|---|---|---|---|---|
| **Date** | May 4-6 | May 11-12 | May 26 | Jul 11 |
| **Temperature** | 12°C | 14°C | 18°C | 20°C |

## METHODS

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| Spring | Minnow seine | 0.5m |
| | Beach seine | 0.5m |
| May 27 | ¶Three-minute tows | See Table 11-1 |
| Summer | Minnow seine | 0.5m |

¶Supplementary data

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 60.40 |  |  |  | 14.15 | 130.61 |  | 72.38 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  | 4.08 |  | 2.04 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.27 |  |  | 0.14 |
| Ninespine stickleback |  |  |  |  |  | 2.45 |  | 1.23 |
| Yellow perch | 6.20 |  |  |  |  | 126.53 |  | 63.27 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 4.24 |  |  |  | 15.23 | 32.65 |  | 23.94 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 612.6m$^2$<br>434<br>0.709/m$^2$ | NS | NS | 612.6m$^2$<br>434<br>0.709/m$^2$ | 367.6m$^2$<br>109<br>0.297/m$^2$ | 122.5m$^2$<br>363<br>2.963/m$^2$ | NS | 245.0m$^2$<br>236<br>0.963/m$^2$ |

NS = not sampled

## LAKE SITE

Site Number 11-7
Lake Name Wolf Lake
Location See Figure 11-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Gradual increase in depth from shoreline: 30m-0.5m, 60m-1.75m, 90m-2.0m |
| Shoreline Features | No true bank. |
| Aquatic Vegetation | Submergent vegetation 20m from shoreline. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 4-6 | May 11-12 | May 26 | Jul 11 | Oct 7-9 |
|---|---|---|---|---|---|
| Temperature | 7.5°C | 15°C | 14°C | 18°C | 7°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Spring | Minnow seine | 0.25m |
| May 27 | ¶Three-minute tow | See Table 11-1 |
| Summer | Minnow seine<br>Beach seine | 0.25m |
| Fall | Minnow seine<br>Beach seine | 0.25m |

¶Supplementary data

FISH CAPTURES

| | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| Species | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | 0.16 | | 0.08 | 31.01 | 15.51 | 19.59 | 22.04 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | 0.98 | | 0.49 | | 2.45 | 5.71 | 2.72 |
| Burbot | | 0.16 | | 0.08 | | | | |
| Brook stickleback | | | | | | | 0.82 | 0.27 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | 66.27 | 0.33 | 33.30 | | 12.24 | 4.08 | 5.44 |
| Yellow walleye | | 0.16 | | 0.08 | | | | |
| Iowa darter | | 0.82 | | 0.41 | 1.90 | 7.35 | 6.53 | 5.26 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | NS | 612.6$m^2$ | 612.6$m^2$ | 612.6$m^2$ | 367.6$m^2$ | 122.5$m^2$ | 122.5$m^2$ | 204.2$m^2$ |
| Total Catch | | 420 | 2 | 211 | 121 | 46 | 45 | 70.7 |
| Catch/Unit Effort | | 0.686/$m^2$ | 0.003/$m^2$ | 0.344/$m^2$ | 0.329/$m^2$ | 0.376/$m^2$ | 0.367/$m^2$ | 0.346/$m^2$ |

NS = not sampled

**LAKE SITE**

| | |
|---|---|
| **Site Number** | 11-8 |
| **Lake Name** | Wolf Lake |
| **Location** | See Figure 11-1 |

**SITE CHARACTERISTICS**

| | |
|---|---|
| **Depth Range** | Gradual increase in depth from shoreline: 30m-0.75m, 60m-1.0m, 90m-1.0m. |
| **Shoreline Features** | Bank 3m high. Grasses, shrubs, trees. Rubble along shore. |
| **Aquatic Vegetation** | 90-100% cover of emergent reeds and submergent vegetation. |
| **Substrate Type** | Sand 90%. Rubble 10%. |

**SURFACE TEMPERATURE**

| **Date** | May 4-6 | May 11-12 | May 26 | Jul 11 | Oct 7-9 |
|---|---|---|---|---|---|
| **Temperature** | 7°C | 14.5°C | 15°C | 18°C | 7°C |

**METHODS**

| **Date** | **Method** | **Depth of Set** |
|---|---|---|
| Spring | Minnow seine<br>Beach seine | 0.75<br>0.75m |
| Summer | Minnow seine | 0.75m |
| Fall | Minnow seine | 0.75m |

FISH CAPTURES

| Species | Beach Seine | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 0.90 | | | | 179.54 | | | 59.85 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.08 | | | | | 0.82 | | 0.27 |
| Burbot | | | | | | | 5.71 | 1.90 |
| Brook stickleback | | | | | 0.27 | | 8.98 | 3.08 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 1.63 | | | | | 3.27 | | 1.09 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 1.31 | | | | 21.76 | 1.63 | 0.82 | 8.07 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 1225.2m²<br>49<br>0.040/m² | NS | NS | 1225.2m²<br>49<br>0.040/m² | 367.6m²<br>741<br>2.016/m² | 122.5m²<br>7<br>0.057/m² | 122.5m²<br>19<br>0.155/m² | 204.2m²<br>255.7<br>1.252/m² |

NS = not sampled

## LAKE SITE

Site Number 11-9

Lake Name Wolf Lake

Location See Figure 11-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Depth Range | Uniform depth for 90m from shoreline: 30m-0.75m, 60m-0.75m, 90m-0.75m |
| Shoreline Features | Bank 1m high. Grasses, shrubs, and trees. |
| Aquatic Vegetation | Emergent reeds and submergent vegetation. |
| Substrate Type | Sand 100%. |

## SURFACE TEMPERATURE

| Date | May 11-12 | May 26 | Jul 11 | Oct 7-9 |
|---|---|---|---|---|
| Temperature | 13°C | 17°C | 20°C | 9°C |

## METHODS

| Date | Method | Depth of Set |
|---|---|---|
| Spring | Minnow seine<br>Beach seine | 0.5m<br>0.75m |
| Summer | Minnow seine<br>Beach seine | 0.5m<br>0.75m |
| Fall | Minnow seine<br>Beach seine | 0.5m<br>0.75m |

FISH CAPTURES

| Species | Beach Seine |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike |  |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner | 0.33 | 0.65 |  | 0.33 | 1.47 | 3.27 | 13.06 | 5.93 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker |  |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 5.88 |  |  | 1.96 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  | 0.82 |  | 0.27 |  |  | 0.82 | 0.27 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter | 0.16 |  |  | 0.05 | 42.12 |  | 42.45 | 28.19 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 612.6m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 612.6m$^2$ | 204.2m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 149.7 |
| Total Catch | 3 | 9 | 0 | 4 | 101 | 4 | 69 | 58 |
| Catch/Unit Effort | 0.005/m$^2$ | 0.015/m$^2$ | 0.00/m$^2$ | 0.007/m$^2$ | 0.495/m$^2$ | 0.033/m$^2$ | 0.563/m$^2$ | 0.387/m$^2$ |

Table 11-1 Summary of catches per effort of fish taken by various methods for Wolf Lake, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 3144.7 m$^2$ | | 857.6 m$^2$ | | 980.2 m$^2$ | | 1660.8 m$^2$ | |
| Total Catch | 2326 | | 1433 | | 459 | | 1406 | |
| Catch/Unit Effort | 0.739/m$^2$ | | 1.671/m$^2$ | | 0.468/m$^2$ | | 0.847/m$^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 63.25 | 85.5 | 22.62 | 13.5 | 34.48 | 73.6 | 40.12 | 57.5 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| ¶White sucker | | | 64.02 | 38.3 | 0.92 | 1.9 | 21.65 | 13.4 |
| Burbot | | | 0.12 | 0.1 | 0.71 | 1.5 | 0.28 | 0.5 |
| Brook stickleback | 0.45 | 0.6 | | | 1.22 | 2.6 | 0.56 | 1.1 |
| Ninespine stickleback | 0.06 | 0.1 | 0.47 | 0.3 | | | 0.18 | 0.1 |
| ¶yellow perch | 0.48 | 0.6 | 73.23 | 43.8 | 1.02 | 2.2 | 24.91 | 15.5 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 9.73 | 13.2 | 6.65 | 3.9 | 8.47 | 18.1 | 8.28 | 11.7 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

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¶Catches of larvae in seven standard three-minutes tows: white sucker 1, catch/min 0.05; yellow perch 82, catch/min 3.91.

Table 11-1 Continued.

| | Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 11026.8 m² | | 3063.0 m² | | 3675.6 m² | | 5921.8 m² | |
| Total Catch | 1467 | | 4037 | | 610 | | 2038 | |
| Catch/Unit Effort | 0.133/m² | | 1.318/m² | | 0.166/m² | | 0.344/m² | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.03 | 0.2 | | | 0.03 | 0.2 | 0.02 | 0.1 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 5.83 | 43.8 | 1.21 | 0.9 | | | 2.35 | 14.9 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 0.85 | 6.4 | 0.72 | 0.5 | 0.46 | 2.8 | 0.68 | 3.2 |
| Burbot | 0.01 | 0.1 | 0.03 | <0.1 | 0.03 | 0.2 | 0.02 | 0.1 |
| Brook stickleback | 0.05 | 0.3 | | | | | 0.02 | 0.1 |
| Ninespine stickleback | 0.04 | 0.3 | | | | | 0.01 | 0.1 |
| yellow perch | 5.73 | 43.1 | 129.64 | 98.4 | 16.08 | 96.9 | 50.48 | 79.5 |
| Yellow walleye | | | 0.03 | <0.1 | | | 0.01 | <0.1 |
| Iowa darter | 0.77 | 5.8 | 0.16 | 0.1 | | | 0.31 | 2.0 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 11-1 Concluded.

| | Gillnet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 38.0 hr | | N.S. | | 90.0 hr | | 64.0 hr | |
| Total Catch | 37 | | | | 59 | | 48 | |
| Catch/Unit Effort | 0.974/hr | | | | 0.656/hr | | 0.750/hr | |
| | | | | | | | Means | |
| Species | CPM[2] x100 | % | CPM[2] x100 | % | CPM[2] x100 | % | CPM[2] x100 | % |
| Lake whitefish | | | | | 6.68 | 10.1 | 3.34 | 5.0 |
| Lake cisco | | | | | | | | |
| Northern pike | 60.53 | 62.2 | | | 25.56 | 38.9 | 43.05 | 50.6 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dacc | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | 28.89 | 44.2 | 14.45 | 22.1 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | 5.26 | 5.4 | | | | | 2.63 | 2.7 |
| yellow perch | 28.95 | 29.7 | | | | | 14.48 | 14.9 |
| Yellow walleye | 2.63 | 2.7 | | | 4.44 | 6.8 | 3.54 | 4.8 |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 11-2 Summary of length-frequency data for fish captured in Wolf Lake, 1981. Total catch represents number captured, length-frequencies are expressed in percentage.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | 6 | | | | | 5 | 48 | | | | | | | | | | 110 | 24 | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | 3.6 | | |
| 51-75 | | | | | | | | | | | | | | | | | | | 88.2 | 41.7 | |
| 76-100 | | | | | | | | | | | | | | | | | | | 8.1 | 45.8 | |
| 101-125 | | | | | | | | | | | | | | | | | | | | 12.5 | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | 2.1 | | | | | | | | | | | | |
| 226-250 | | | | | | | | 20.0 | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 4.2 | | | | | | | | | | | | |
| 351-375 | | | 16.7 | | | | | 20.0 | 8.3 | | | | | | | | | | | | |
| 376-400 | | | 50.0 | | | | | | 2.1 | | | | | | | | | | | | |
| 401-425 | | | 16.7 | | | | | | 4.2 | | | | | | | | | | | | |
| 426-450 | | | 16.7 | | | | | 20.0 | 8.3 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 14.6 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 6.3 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 8.3 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 6.3 | | | | | | | | | | | | |
| 551-575 | | | | | | | | 20.0 | 6.3 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | 6.3 | | | | | | | | | | | | |
| 626-650 | | | | | | | | 20.0 | 6.3 | | | | | | | | | | | | |
| 651-675 | | | | | | | | | 2.1 | | | | | | | | | | | | |
| 676-700 | | | | | | | | | 6.3 | | | | | | | | | | | | |
| 701-625 | | | | | | | | | 2.1 | | | | | | | | | | | | |
| 726-750 | | | | | | | | | 2.1 | | | | | | | | | | | | |
| 751-775 | | | | | | | | | 2.1 | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table 11-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | 16 | 24 | 26 | 7 | 3 | | 17 | 2 | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | 37.5 | | | 42.9 | 33.3 | | 100.0 | | |
| 51-75 | | | | | | | | | | | | | 25.0 | | | 14.3 | | | | 100.0 | |
| 76-100 | | | | | | | | | | | | | 31.3 | 29.2 | | 42.9 | 33.3 | | | | |
| 101-125 | | | | | | | | | | | | | 6.3 | 8.3 | | | | | | | |
| 126-150 | | | | | | | | | | | | | | 12.5 | | | 33.3 | | | | |
| 151-175 | | | | | | | | | | | | | | 4.2 | | | | | | | |
| 176-200 | | | | | | | | | | | | | | 16.7 | | | | | | | |
| 201-225 | | | | | | | | | | | | | | 12.5 | | | | | | | |
| 226-250 | | | | | | | | | | | | | | 4.2 | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 3.8 | | | | | | |
| 426-450 | | | | | | | | | | | | | | 4.2 | 7.7 | | | | | | |
| 451-475 | | | | | | | | | | | | | | 8.3 | 26.9 | | | | | | |
| 476-500 | | | | | | | | | | | | | | | 38.5 | | | | | | |
| 501-525 | | | | | | | | | | | | | | | 15.4 | | | | | | |
| 526-550 | | | | | | | | | | | | | | | 7.7 | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 11-2 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | 2 | 4 | 2 | 32 | 92 | 11 | | 1 | 5 | 83 | 27 | | | | | | | | | | |
| 0-25 | | | | 3.1 | | | | | | 7.2 | | | | | | | | | | | |
| 26-50 | 100.0 | 50.0 | | 50.0 | 5.4 | | | | | 92.8 | 85.2 | | | | | | | | | | |
| 51-75 | | 50.0 | 50.0 | 40.6 | 31.5 | 36.4 | | 100.0 | | | 14.8 | | | | | | | | | | |
| 76-100 | | | 50.0 | 6.3 | 21.7 | | | | | | | | | | | | | | | | |
| 101-125 | | | | | 19.6 | | | | | | | | | | | | | | | | |
| 126-150 | | | | | 10.9 | 36.4 | | | | | | | | | | | | | | | |
| 151-175 | | | | | 6.5 | 27.3 | | | | | | | | | | | | | | | |
| 176-200 | | | | | 4.4 | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 20.0 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 40.0 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 20.0 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | 20.0 | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table 11-3 Summary of catches per effort of fish taken by various methods for Wolf Lake, (site 11-1), 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort<br>Total Catch<br>Catch/Unit Effort | 122.5 m²<br>6<br>0.049/m² | | N.S. | | 122.5 m²<br>168<br>1.371/m² | | 122.5m²<br>87<br>0.710/m² | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | 137.14 | 100.0 | 68.57 | 50.0 |
| Yellow walleye | | | | | | | | |
| Iowa darter | 4.90 | 100.0 | | | | | 2.45 | 50.0 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 11-4 Summary of catches per effort of fish taken by various methods for Wolf Lake (site 11-5), 1981. Both catch per unit effort (x 100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Evening Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 122.5 m² | | N.S. | | N.S. | | | |
| Total Catch | 4 | | | | | | | |
| Catch/Unit Effort | 0.033/m² | | | | | | | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | 2.45 | 75.0 | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | 0.82 | 25.0 | | | | | | |
| yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table 11-5 Summary of catches per effort of fish taken by various methods for Wolf Lake (site 11-5), 1981. Both catch per unit effort (x 100) and percentage of total catch are indicated for each species captured. NS inidcates that no sample was taken.

| | Evening Beach Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 612.6 m² | | N.S. | | 612.6 m² | | 612.6m² | |
| Total Catch | 0 | | | | 127 | | 63.5 | |
| Catch/Unit Effort | 0.00/m² | | | | 0.207/m² | | 0.104/m² | |
| | | | | | | | Means | |
| Species | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % | CPM² x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | 0.33 | 1.6 | 0.16 | 1.6 |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | 0.65 | 3.2 | 0.33 | 3.2 |
| yellow perch | | | | | 19.75 | 95.3 | 9.88 | 95.3 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

# A. BEAVER RIVER

Three sampling sites (A-1 to A-3) were established on the Beaver River (Figure A-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Stream Site sheets. Data summaries for the Beaver are presented in Table A-1 (catch-per-unit-effort) and Table A-2 (length frequencies). Tables A-3 and A-4 divide the information for two of the sampling sites into three habitat areas having slightly different characteristics.

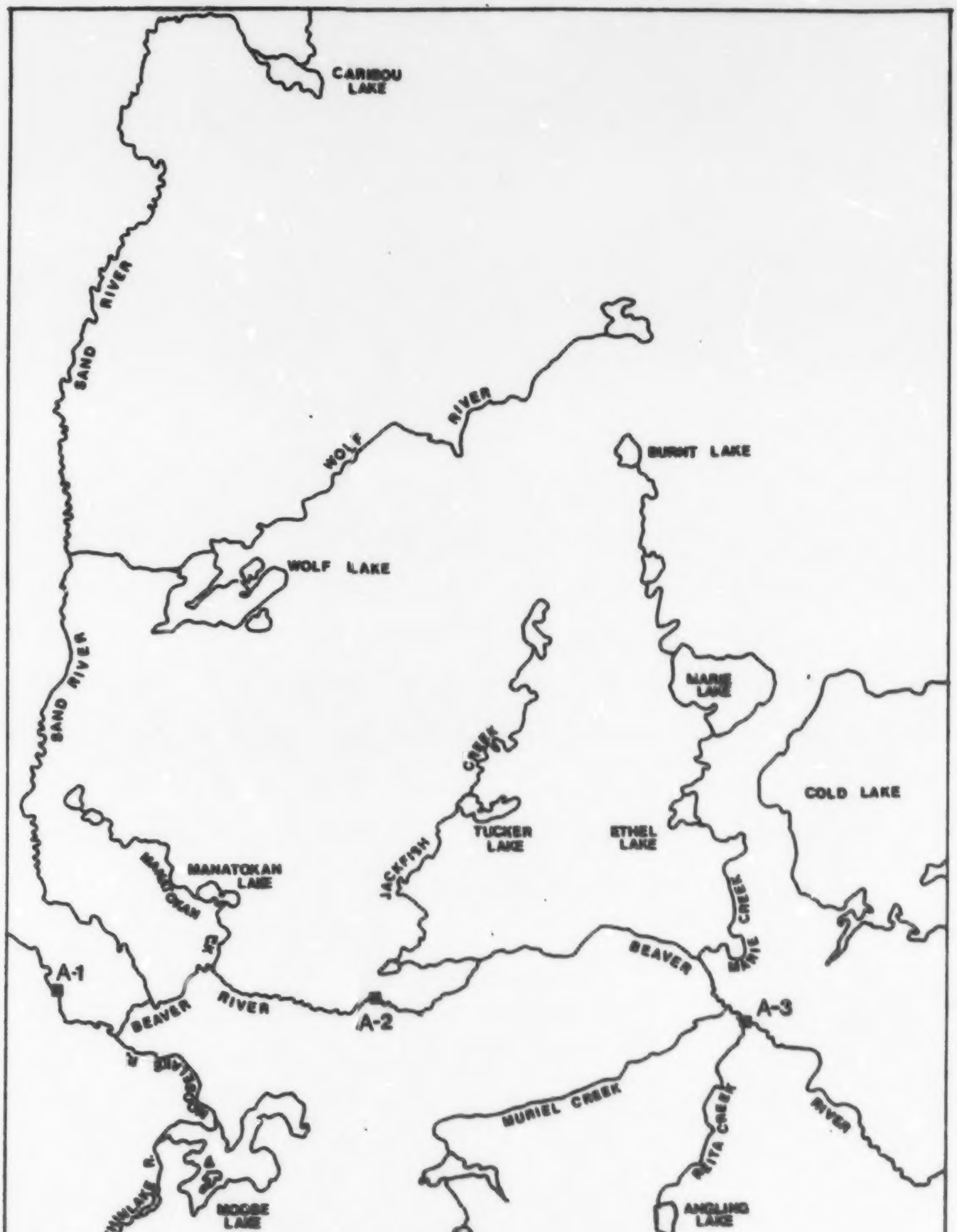
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN
MARIE CREEK
BEAVER
A-1
BEAVER
RIVER
A-2
A-3
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE
0
5
10
20
MILES
0
5
10
20
KM

Figure A-1 Map showing sampling sites on the Beaver River

## STREAM SITE

Site Number A-1

Stream Name Beaver River

Location See Figure A-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Bank Features | Steep bank, 2m high. 45° angle. Composed of boulders and rocks. Grasses and willows. |
| Aquatic Vegetation | None. |
| Substrate Type | Silt/mud 40%. Rubble 25%. Boulder 25%. Organic 10%. |

## SURFACE TEMPERATURE

| Date | Apr | | | | May | | | | | | Jul | Oct |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 25 | 29 | 30 | 2 | 5 | 9 | 13 | 15 | 21 | 8 | 1 |
| Temperature (°C) | 4 | 9 | 9 | 8 | 11.5 | 12 | 11 | 13 | 13 | 19 | 15 | 8 |

## METHODS

| Dates | Method | |
|---|---|---|
| Apr 25, 29, May 2-21, Jul 8, Oct 1 | Gillnets | |
| Apr 29, May 6, 13, Jul 8 | ¶Minnow seine | See Table A-3 |
| Oct 2 | Electroshock | |

ELECTROFISHING DATA

| | C/secx100 |
|---|---|
| Pearl Dace | 2.89 |
| White sucker | 0.58 |
| Yellow perch | 0.58 |
| Total Effort | 173 sec |
| Total Catch | 7 |
| Total Catch/Effort | 0.041/sec |

¶Supplementary data

## FISH CAPTURES

| Species | Gillnet Spring CPH x100 | Gillnet Summer CPH x100 | Gillnet Fall CPH x100 | Gillnet Mean CPH x100 | Minnow Seine Spring CPM$^2$ x100 | Minnow Seine Summer CPM$^2$ x100 | Minnow Seine Fall CPM$^2$ x100 | Minnow Seine Mean CPM$^2$ x100 |
|---|---|---|---|---|---|---|---|---|
| Lake whitefish | | | 8.70 | 2.90 | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 5.84 | | 21.74 | 9.19 | | | | |
| Lake chub | | | | | 1.53 | | | 0.77 |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | 6.73 | | | 3.37 |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | 3.50 | | 4.35 | 2.62 | 0.31 | 80.82 | | 41.64 |
| White sucker | 9.93 | 20.83 | 26.09 | 18.95 | 2.14 | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | 42.55 | | | 21.28 |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | 4.35 | 1.45 | | | | |
| Yellow walleye | 9.34 | | 13.04 | 7.46 | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 171.25 hr | 24 hr | 23 hr | 72.8 hr | 326.7$m^2$ | 122.5$m^2$ | NS | 224.6$m^2$ |
| Total Catch | 49 | 5 | 18 | 24 | 174 | 99 | | 136.5 |
| Catch/Unit Effort | 0.286/hr | 0.208/hr | 0.783/hr | 0.329/hr | 0.533/$m^2$ | 0.808/$m^2$ | | 0.608/$m^2$ |

NS = not sampled

## STREAM SITE

**Site Number** A-2

**Stream Name** Beaver River

**Location** See Figure A-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Bank Features** | Low slope. Grasses and willows. |
| **Aquatic Vegetation** | None. |
| **Substrate Type** | Sand 70%. Sand/silt 30%. |

## SURFACE TEMPERATURE

| Date | Apr | | | | May | | | | | | Jul | Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 25 | 28 | 30 | 4 | 6 | 11 | 14 | 15 | 21 | 8 | 4 | 5 |
| Temperature | 8°C | 9 | 8 | 10 | 9 | 10 | 11.5 | 14 | 11 | 18 | 17 | 4.5 | 3 |

## METHODS

| Dates | Method | |
|---|---|---|
| Apr 23-30, May 4-21, Jul 9, Oct 4 | Gillnet | |
| Apr 27, May 6, 14, Jul 9, Oct 4 | ¶Minnow seines | See Table A-4 |
| May 9, 16, 17, 23 - 24 | Drift bomb | |
| May 24 | Dipnet | |

DRIFT BOMB DATA (+ dipnet)

| Date | Time | No.Fry | Eggs | Species |
|---|---|---|---|---|
| May 9 | 0500-0600 | nil | nil | |
| | 0900-1000 | nil | nil | |
| May 16 | 2100-2200 | nil | nil | |
| | 0100-0200 | nil | nil | |
| May 17 | 0500-0600 | nil | nil | |
| | 0900-1000 | nil | nil | |
| | 1300-1400 | nil | nil | |
| May 23/24 | 1000-1600 | 11 | nil | sucker |
| | 1600-1200 | 3 | nil | sucker |
| May 24 | Dipnet | 602 | nil | sucker |

¶Supplementary data

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 2.06 |  | 9.76 | 3.94 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  | 0.17 |  |  | 0.06 |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  | 0.17 |  |  | 0.06 |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  | 5.25 |  |  | 1.75 |
| Longnose sucker | 1.54 |  | 29.27 | 10.27 | 0.17 | 454.29 |  | 165.83 |
| White sucker | 10.28 |  | 19.51 | 9.93 | 43.03 |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.52 |  |  | 0.17 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye | 2.06 |  | 29.27 | 10.44 |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 194.5 hr | 24 hr | 20.5 hr | 46.3 hr | 571.7m² | 245 | 122.5m² | 313.1m² |
| Total Catch | 31 | 0 | 18 | 16.3 | 282 | 1113 | 0 | 465 |
| Catch/Unit Effort | 0.159/hr | 0.00/hr | 0.878/hr | 0.353/hr | 0.493/m² | 4.543/m² | 0.00/m² | 1.485/m² |

## STREAM SITE

**Site Number** A-3

**Stream Name** Beaver River

**Location** See Figure A-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Bank Features** | Low bank. Grasses and willows. |
| **Aquatic Vegetation** | None. |
| **Substrate Type** | Silt/mud 95%. Organic 5%. |

## SURFACE TEMPERATURE

| Date | Apr | | | | May | | | | | | Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 28 | 29 | 30 | 4 | 6 | 11 | 15 | 18 | 21 | 4 | 5 |
| Temperature | 8°C | 8 | 9 | 10 | 11 | 10 | 11 | 10 | 16 | 19.5 | 5.5 | 5.5 |

## METHODS

| Dates | Method |
|---|---|
| Apr 23-30, May 4-20, Oct 4 | Gillnets |
| May 1, 6, 14, 18 | Minnow seine* |

* Main channel only was sampled on May 1

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 7.66 |  | 7.55 | 7.61 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker | 3.83 |  | 3.77 | 3.70 | 0.20 |  |  |  |
| White sucker | 30.63 |  | 15.09 | 22.86 | 11.22 |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye | 12.25 |  | 37.74 | 24.99 |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 130.6 hr |  | 26.5 hr | 78.6 hr | 490.1m$^2$ |  |  | 490.1m$^2$ |
| Total Catch | 71 | NS | 17 | 44 | 56 | NS | NS | 56 |
| Catch/Unit Effort | 0.544/hr |  | 0.642/hr | 0.559/hr | 0.114/m$^2$ |  |  | 0.114/m$^2$ |

NS = not sampled

Table A-1 Summary of catches per effort of fish taken by various methods for Beaver River, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured.

| | Gillnet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 496.4 hr | | 48 hr | | 70 hr | | 204.8 hr | |
| Total Catch | 151 | | 5 | | 53 | | 67.7 | |
| Catch/Unit Effort | 0.304/hr | | 0.104/hr | | 0.757/hr | | 0.340/hr | |
| | | | | | | | Means | |
| Species | CPhr x100 | % | CPhr x100 | % | CPhr x100 | % | CPhr x100 | % |
| Lake whitefish | | | | | 2.86 | 3.8 | 0.95 | 1.3 |
| Lake cisco | | | | | | | | |
| Northern pike | 4.83 | 15.9 | | | 12.86 | 16.9 | 5.89 | 10.9 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | 2.82 | 9.3 | | | 11.43 | 15.1 | 4.75 | 8.1 |
| White sucker | 15.51 | 50.9 | 10.42 | 100.0 | 20.0 | 26.4 | 15.31 | 59.1 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | 1.43 | 1.9 | 0.48 | 0.6 |
| Yellow walleye | 7.25 | 23.8 | | | 27.14 | 35.9 | 11.46 | 19.9 |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Continued.....

Table A-1 Concluded.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 1388.6m$^2$ | | 367.6m$^2$ | | 122.5m$^2$ | | 626.2m$^2$ | |
| Total Catch | 512 | | 1212 | | 0 | | 574.7 | |
| Catch/Unit Effort | 0.369/m$^2$ | | 3.297/m$^2$ | | 0.00/m$^2$ | | 0.918/m$^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | 0.36 | 1.0 | | | | | 0.12 | 0.5 |
| Emerald shiner | 0.07 | 0.2 | | | | | 0.02 | 0.1 |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | 1.66 | 4.5 | | | | | 0.55 | 2.3 |
| Longnose dace | | | | | | | | |
| Pearl dace | 2.16 | 5.9 | | | | | 0.72 | 3.0 |
| Longnose sucker | 22.40 | 60.7 | 329.71 | 100 | | | 117.37 | 80.4 |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | 10.23 | 27.7 | | | | | 3.41 | 13.9 |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table A - 2 Summary of length-frequency data for fish captured in Beaver River, 1981. Total catch represents number captured, length-frequencies are expressed in percentage.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch(n) | | | 2 | | | | | | 36 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | 2.8 | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | 2.8 | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | 2.8 | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 8.3 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 5.6 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 13.9 | | | | | | | | | | | | |
| 401-425 | | | 100.0 | | | | | | 11.1 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 22.2 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 8.3 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 11.1 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 8.3 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 2.8 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table A - 2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 5 | | | | | 21 | 1 | | 104 | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | 20.0 | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | 80.0 | | | | | 4.8 | 100.0 | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | 1.0 | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | 4.8 | | | 2.9 | | | | | | |
| 301-325 | | | | | | | | | | | | | | | 2.9 | | | | | | |
| 326-350 | | | | | | | | | | | | | | | 3.9 | | | | | | |
| 351-375 | | | | | | | | | | | | 19.0 | | | 10.6 | | | | | | |
| 376-400 | | | | | | | | | | | | 28.6 | | | 15.4 | | | | | | |
| 401-425 | | | | | | | | | | | | 33.3 | | | 30.8 | | | | | | |
| 426-450 | | | | | | | | | | | | 4.8 | | | 17.3 | | | | | | |
| 451-475 | | | | | | | | | | | | 4.8 | | | 11.5 | | | | | | |
| 476-500 | | | | | | | | | | | | | | | 1.9 | | | | | | |
| 501-525 | | | | | | | | | | | | | | | 1.0 | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table A - 2 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 1 | | | | | 50 | | | | | | | 5 | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | 100.0 | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | 100.0 | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | 4.0 | | | | | | | | | | | | |
| 251-275 | | | | | | | | | 16.0 | | | | | | | | | | | | |
| 276-300 | | | | | | | | | 8.0 | | | | | | | | | | | | |
| 301-325 | | | | | | | | | 2.0 | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 12.0 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 8.0 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 12.0 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 18.0 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 14.0 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 6.0 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table A - 3 Summary of catches per effort of fish taken in various habitats for Beaver River, 1981 (Site A-1). Catch per unit effort (x100) is indicated for each species captured. NS indicates that no sample was taken.

| Minnow Seine | Main Channel | | | Side Channel | | | Backwater | | |
|---|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Spring | Summer | Fall | Spring | Summer | Fall |
| Effort | 81.7$m^2$ | | | | | | 245.0$m^2$ | 122.5$m^2$ | |
| Total Catch | 89 | NS | NS | NS | NS | NS | 85 | 99 | NS |
| Catch/unit Effort | 1.089/$m^2$ | | | | | | 0.347/$m^2$ | 0.808/$m^2$ | |
| Species | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 |
| Lake whitefish | | | | | | | | | |
| Lake cisco | | | | | | | | | |
| Northern pike | | | | | | | | | |
| Lake chub | | | | | | | 2.04 | | |
| Emerald shiner | | | | | | | | | |
| River shiner | | | | | | | | | |
| Spottail shiner | | | | | | | | | |
| Fathead minnow | 24.48 | | | | | | 0.82 | | |
| Longnose dace | | | | | | | | | |
| Pearl dace | | | | | | | | | |
| Longnose sucker | | | | | | | 0.41 | 80.82 | |
| White sucker | | | | | | | 2.86 | | |
| Burbot | | | | | | | | | |
| Brook stickleback | 84.46 | | | | | | 28.57 | | |
| Ninespine stickleback | | | | | | | | | |
| Yellow perch | | | | | | | | | |
| Yellow walleye | | | | | | | | | |
| Iowa dater | | | | | | | | | |
| Logperch | | | | | | | | | |
| Slimy sculpin | | | | | | | | | |

Table A - 4 Summary of catches per effort of fish taken in various habitats for Beaver River, 1981 (Site A-2). Catch per unit effort (x100) is indicated for each species captured. NS indicates that no sample was taken.

| Minnow Seine | Main Channel | | | Side Channel | | | Backwater | | |
|---|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Spring | Summer | Fall | Spring | Summer | Fall |
| Effort | 326.7m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 122.5m$^2$ | | | 122.5m$^2$ | 122.5m$^2$ | |
| Total Catch | 114 | 63 | 0 | 167 | NS | NS | 1 | 1050 | NS |
| Catch/unit Effort | 0.349/m$^2$ | 0.514/m$^2$ | 0.00/m$^2$ | 1.363/m$^2$ | | | 0.008/m$^2$ | 8.571/m$^2$ | |
| Species | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 |
| Lake whitefish | | | | | | | | | |
| Lake cisco | | | | | | | | | |
| Northern pike | | | | | | | | | |
| Lake chub | | | | | | | | | |
| Emerald shiner | | | | 0.82 | | | | | |
| River shiner | | | | | | | | | |
| Spottail shiner | | | | | | | | | |
| Fathead minnow | | | | 0.82 | | | | | |
| Longnose dace | | | | | | | | | |
| Pearl dace | 9.18 | | | | | | | | |
| Longnose sucker | 0.31 | } 51.43 | | | | | | } 857.14 | |
| White sucker | 24.49 | | | 134.69 | | | 0.81 | | |
| Burbot | | | | | | | | | |
| Brook stickleback | 0.92 | | | | | | | | |
| Ninespine stickleback | | | | | | | | | |
| Yellow perch | | | | | | | | | |
| Yellow walleye | | | | | | | | | |
| Iowa dater | | | | | | | | | |
| Logperch | | | | | | | | | |
| Slimy sculpin | | | | | | | | | |

## B. JACKFISH CREEK

Two sampling sites (B-1 and B-2) were established on Jackfish Creek (Figure B-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented for both sites on numbered Stream Site sheets. Data summaries for Jackfish Creek are presented in Table B-1 (catch-per-unit effort) and Table B-2 (length frequencies).

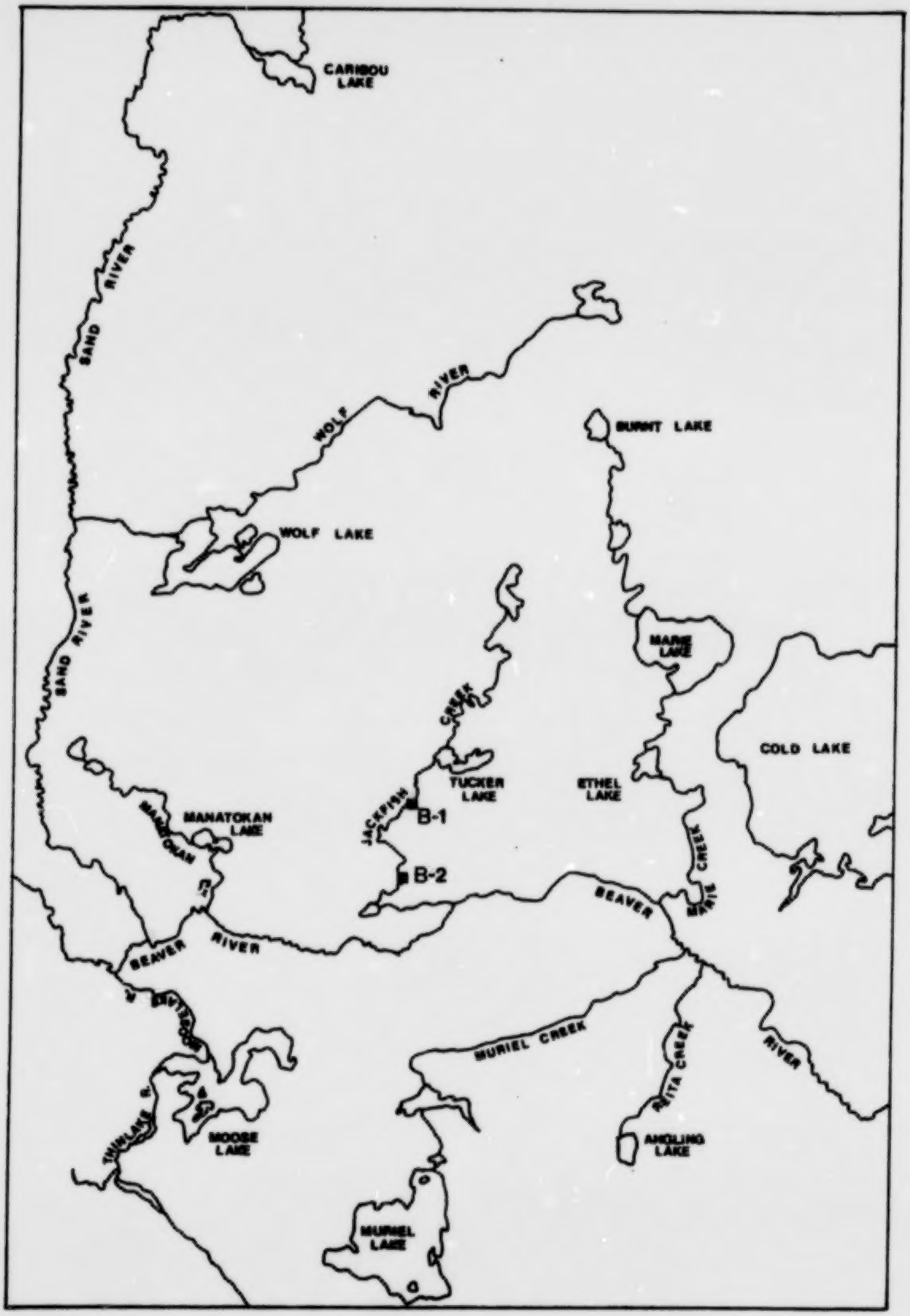
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
CREEK
COLD LAKE
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN
JACKFISH
B-1
B-2
CR.
MARIE CREEK
BEAVER
BEAVER RIVER
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE
0 5 10 20 MILES
0 5 10 20 KM

Figure B-1 Map showing sampling sites on Jackfish Creek

**STREAM SITE**

Site Number: B-1
Stream Name: Jackfish Creek
Location: See Figure B-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| Bank Features | Steep bank, 1 m high; >45° slope; grasses present |
| Aquatic Vegetation | 50 - 75% cover of emergent and submergent vegetation |
| Substrate Type | 100% silt/mud |

**SURFACE TEMPERATURE**

| Date | April 26 | May 18 | July 18 | October 4 |
|---|---|---|---|---|
| Temperature | 6°C | 14°C | 21°C | 5°C |

**METHODS**

| DATE | METHOD |
|---|---|
| April 26 | minnow seine, gillnet |
| May 18 | minnow seine, gillnet |
| July 18 | minnow seine, gillnet |
| October 4 | minnow seine, gillnet |

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 39.02 | 9.62 | 17.78 | 22.14 | 0.24 |  |  | 0.08 |
| Lake chub |  |  |  |  | 0.24 |  |  | 0.08 |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  | 0.24 |  |  | 0.08 |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  | 5.39 | 5.71 | 0.82 | 3.97 |
| Longnose sucker | 19.51 |  |  | 6.50 | 0.48 |  |  | 0.17 |
| White sucker | 32.52 | 53.01 | 31.11 | 38.88 | 18.85 |  |  | 6.28 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 3.92 | 8.98 | 75.10 | 29.33 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 3.25 | 28.92 | 4.44 | 12.20 |  | 0.82 |  | 0.27 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 30.75 hr | 20.75 hr | 22.5 hr | 24.7 hr | 408.4 $m^2$ | 122.5 $m^2$ | 122.5 $m^2$ | 217.8 $m^2$ |
| Total Catch | 29 | 19 | 12 | 20 | 120 | 19 | 93 | 77.3 |
| Catch/Unit Effort | 0.943/hr | 0.918/hr | 0.533/hr | 0.809/hr | 0.294/$m^2$ | 0.155/$m^2$ | 0.759/$m^2$ | 0.355/$m^2$ |

## STREAM SITE

Site Number B-2

Stream Name Jackfish Creek

Location See Figure B-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Bank Features | Steep bank, 1 m high;>45° slope; grasses present |
| Aquatic Vegetation | 50 - 75% cover of emergent and submergent vegetation |
| Substrate Type | 100% silt/mud |

## SURFACE TEMPERATURE

| Date | April 26 | April 27 | May 18 | July 18 | October 4 |
|---|---|---|---|---|---|
| Temperature | 5.5°C | 6°C | 16.5°C | 22°C | 5°C |

## METHODS

| DATE | METHOD |
|---|---|
| April 26 | gillnet |
| May 18 | gillnet, minnow seine |
| July 18 | gillnet, minnow seine |
| October 4 | gillnet, minnow seine |

## FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 75.51 | 19.05 | 13.64 | 36.07 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 2.04 | 14.29 |  | 5.44 |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 7.34 | 55.51 | 131.43 | 64.76 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  | 15.51 | 5.71 | 7.07 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 49.0 hr | 21.0 hr | 22.0 hr | 30.7 hr | 81.7 m² | 122.5 m² | 122.5 m² | 108.9 m² |
| Total Catch | 38 | 7 | 3 | 16 | 6 | 87 | 168 | 87 |
| Catch/Unit Effort | 0.776/hr | 0.333/hr | 0.136/hr | 0.521/hr | 0.073/m² | 0.710/m² | 1.371/m² | 0.799/m² |

Table B-1 Summary of catches per effort of fish taken by various methods for Jackfish Creek, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 490.1 $m^2$ | | 245.0 $m^2$ | | 245.0 $m^2$ | | 326.7 $m^2$ | |
| Total Catch | 92 | | 106 | | 261 | | 153 | |
| Catch/Unit Effort | 0.188/$m^2$ | | 0.433/$m^2$ | | 1.065/$m^2$ | | 0.468/$m^2$ | |
| | | | | | | | Means | |
| Species | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % | CPM$^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 0.20 | 0.8 | | | | | 0.07 | 0.3 |
| Lake chub | 0.20 | 0.8 | | | | | 0.07 | 0.3 |
| Emerald shiner | | | | | | | | |
| River shiner | 0.20 | 0.8 | | | | | 0.07 | 0.3 |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | 4.49 | 17.5 | 2.86 | 6.6 | 0.41 | 0.4 | 2.59 | 8.2 |
| Longnose sucker | 0.40 | 1.6 | | | | | 0.14 | 0.5 |
| White sucker | 15.71 | 61.1 | | | | | 5.24 | 20.4 |
| Burbot | | | | | | | | |
| Brook stickleback | 4.49 | 17.5 | 32.24 | 74.5 | 103.25 | 96.9 | 46.66 | 62.9 |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | 0.41 | 1.0 | | | 0.14 | 0.3 |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | 7.75 | 17.9 | 2.86 | 2.7 | 3.54 | 6.9 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table B-1 Concluded.

| | Gillnet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 79.75 hr | | 41.75 hr | | 44.5 hr | | 55.3 hr | |
| Total Catch | 67 | | 26 | | 15 | | 36 | |
| Catch/Unit Effort | 0.840/hr | | 0.623/hr | | 0.337/hr | | 0.641/hr | |
| | | | | | | | Means | |
| Species | CPh x100 | % | CPh x100 | % | CPh x100 | % | CPh x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 61.44 | 73.1 | 14.37 | 23.1 | 15.73 | 46.7 | 30.51 | 47.6 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | 7.52 | 9.0 | | | | | 2.51 | 3.0 |
| White sucker | 13.79 | 16.4 | 33.53 | 53.8 | 15.73 | 46.7 | 21.02 | 38.9 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | 1.25 | 1.5 | 14.37 | 23.1 | 2.25 | 6.6 | 5.96 | 10.4 |
| yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table B- 2 Summary of length-frequency data for fish captured in Jackfish Creek, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | 62 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | 1.6 | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | 6.5 | | | | | | | | | | | | |
| 276-300 | | | | | | | | | 6.5 | | | | | | | | | | | | |
| 301-325 | | | | | | | | | 17.7 | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 14.5 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 4.8 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 3.2 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 3.2 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 4.8 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 6.5 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 9.7 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 11.3 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 3.2 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 4.8 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | 1.6 | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table B-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 4 | | | | | 6 | | | 31 | | | | 13 | | |
| 0-25 | | | | | | | 25.0 | | | | | | | | | | | | 15.4 | | |
| 26-50 | | | | | | | 75.0 | | | | | | | | | | | | 84.6 | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | 3.2 | | | | | | |
| 201-225 | | | | | | | | | | | | | | | 22.6 | | | | | | |
| 226-250 | | | | | | | | | | | | | | | 12.9 | | | | | | |
| 251-275 | | | | | | | | | | | | | | | 12.9 | | | | | | |
| 276-300 | | | | | | | | | | | | | | | 12.9 | | | | | | |
| 301-325 | | | | | | | | | | | | | | | 3.2 | | | | | | |
| 326-350 | | | | | | | | | | | | 16.7 | | | | | | | | | |
| 351-375 | | | | | | | | | | | | 33.3 | | | 3.2 | | | | | | |
| 376-400 | | | | | | | | | | | | 33.3 | | | 6.5 | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 22.6 | | | | | | |
| 426-450 | | | | | | | | | | | | 16.7 | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table B-2 Concluded.

| | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 1 | | 7 | | | | 5 | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | 100.0 | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | 100.0 | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | 57.1 | | | | | | | | | | | | | | | |
| 151-175 | | | | | | 14.3 | | | | | | | | | | | | | | | |
| 176-200 | | | | | | 28.6 | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## C. MANATOKAN CREEK

Two sampling sites (C-1 and C-2) were established on Manatokan Creek (Figure C-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented for both sites on numbered Stream Site sheets. Length frequency summaries for Jackfish Creek are presented in Table C-1.

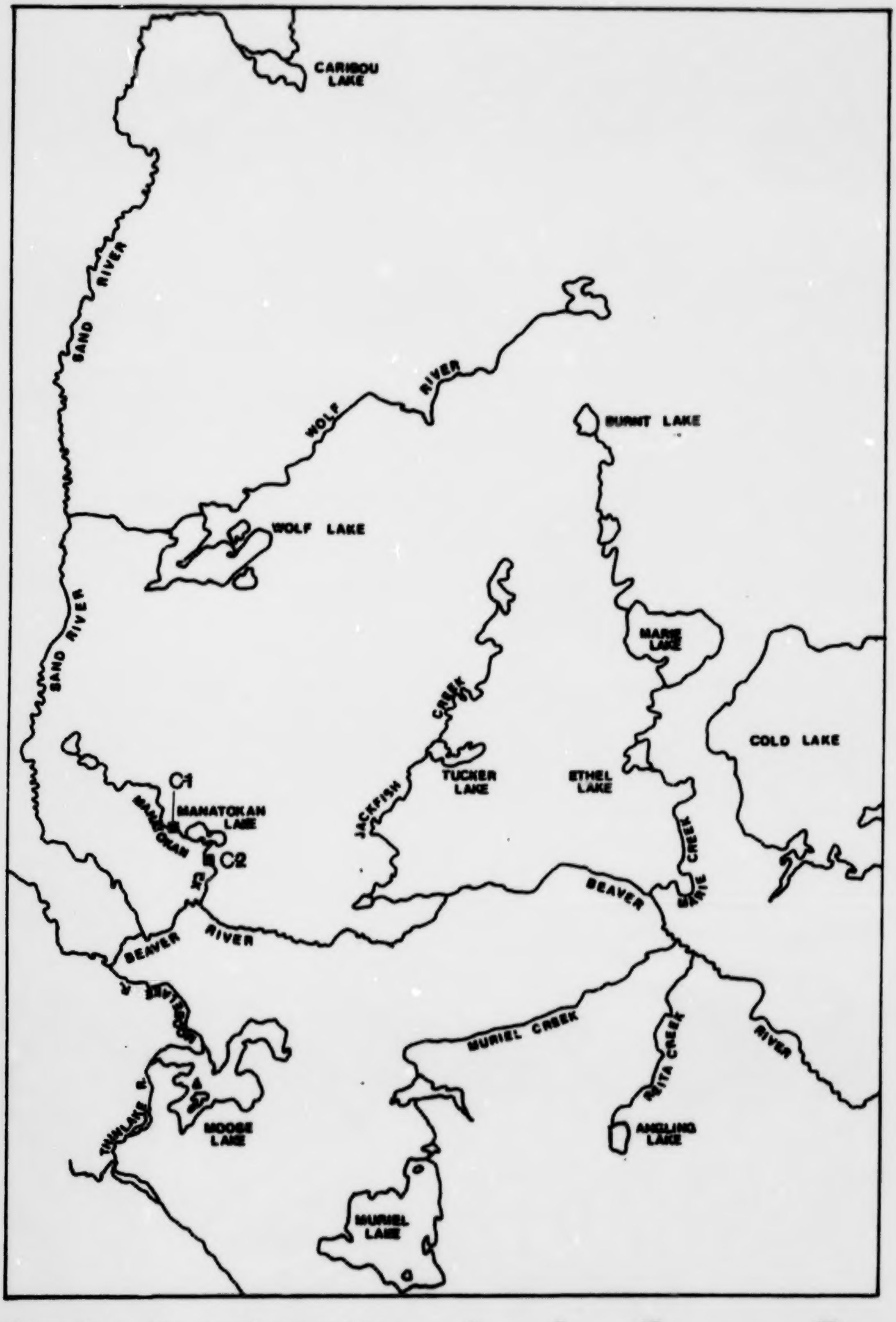
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
CREEK
COLD LAKE
TUCKER LAKE
ETHEL LAKE
C1
MANATOKAN LAKE
MANATOKAN
C2
CR.
JACKFISH
MARIE CREEK
BEAVER
BEAVER RIVER
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
RIVER
MOOSE LAKE
THINLAKE R.
ANGLING LAKE
MURIEL LAKE
0 5 10 20 MILES
0 5 10 20 KM

Figure C-1 Map showing sampling sites on Manatokan Creek

## STREAM SITE

Site Number C-1

Stream Name Manatokan Creek

Location Inflow See Figure C-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Bank Features** | Steep bank; 1.0 - 1.5 m, >45° slope; grasses and overhanging bushes present |
| **Aquatic Vegetation** | nil |
| **Substrate Type** | 100% silt/mud |

## SURFACE TEMPERATURE

| **Date** | April 7 | April 26 | May 15 |
|---|---|---|---|
| **Temperature** | 0°C | 8.5°C | 13.5°C |

## METHODS

Due to low water levels, sampling was restricted to minnow traps (May 14) and minnow seining (April 26, May 14).

| MINNOW TRAPS | CPhr x 100 |
|---|---|
| Yellow perch | 4.17 |
| Total effort | 48 hr |
| Total catch | 2 |
| Total catch/unit effort | 0.042/hr |

FISH CAPTURES

| | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| Species | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 | CPM$^2$x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | | | | | 122.5$m^2$ | N.S. | N.S. | |
| Total Catch | | | | | 0 | | | |
| Catch/Unit Effort | | | | | 0.00/$m^2$ | | | |

NS = not sampled

## STREAM SITE

Site Number C-2

Stream Name Manatokan Creek

Location Outflow See Figure C-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Bank Features | Steep bank; 1.0 - 1.5 m high,>45° slope; grasses and overhanging willows present |
| Aquatic Vegetation | 30 - 40% cover of emergent vegetation |
| Substrate Type | 100% silt/mud |

## SURFACE TEMPERATURE

| Date | April 26 | May 15 | July 13 | October 2 |
|---|---|---|---|---|
| Temperature | 9.5°C | 14.5°C | 27°C | 7°C |

## METHODS

| DATE | METHOD |
|---|---|
| April 26 | minnow seine, gillnet |
| May 14 | minnow seine, gillnet |
| October 2 | electroshock |

| ELECTROSHOCKING DATA | CP2C x 100 |
|---|---|
| Yellow Perch | 0.68 |

| | |
|---|---|
| Total effort | 148 sec. |
| Total catch | 1 |
| Total catch/unit effort | 0.007/sec. |

FISH CAPTURES

| Species | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 32.50 | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | 7.50 | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | 0.41 | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | 5.00 | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 40 hr<br>18<br>0.450/hr | N.S. | N.S. | | 245.0 m²<br>1<br>0.004/m² | N.S. | N.S. | |

NS = not sampled

Table C-1 Summary of length-frequency data for fish captured in Manatokan Creek (outflow), 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | 13 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 7.7 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 15.4 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 15.4 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 15.4 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 30.8 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 7.7 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 7.7 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table C-1 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | 3 | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | 33.3 | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 33.3 | | | | | | |
| 426-450 | | | | | | | | | | | | | | | 33.3 | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table C-1 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 1 | | 2 | | | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | 100.0 | | | | | | | | | | | | | | | |
| 151-175 | | | | 100.0 | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## D. MARIE CREEK

Two sampling sites (D-1 and D-2) were established on Marie Creek (Figure D-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented for both sites on numbered Stream Site sheets. Data summaries for Marie Creek are presented in Table D-1 (catch-per-unit-effort) and Table D-2 (length frequencies).

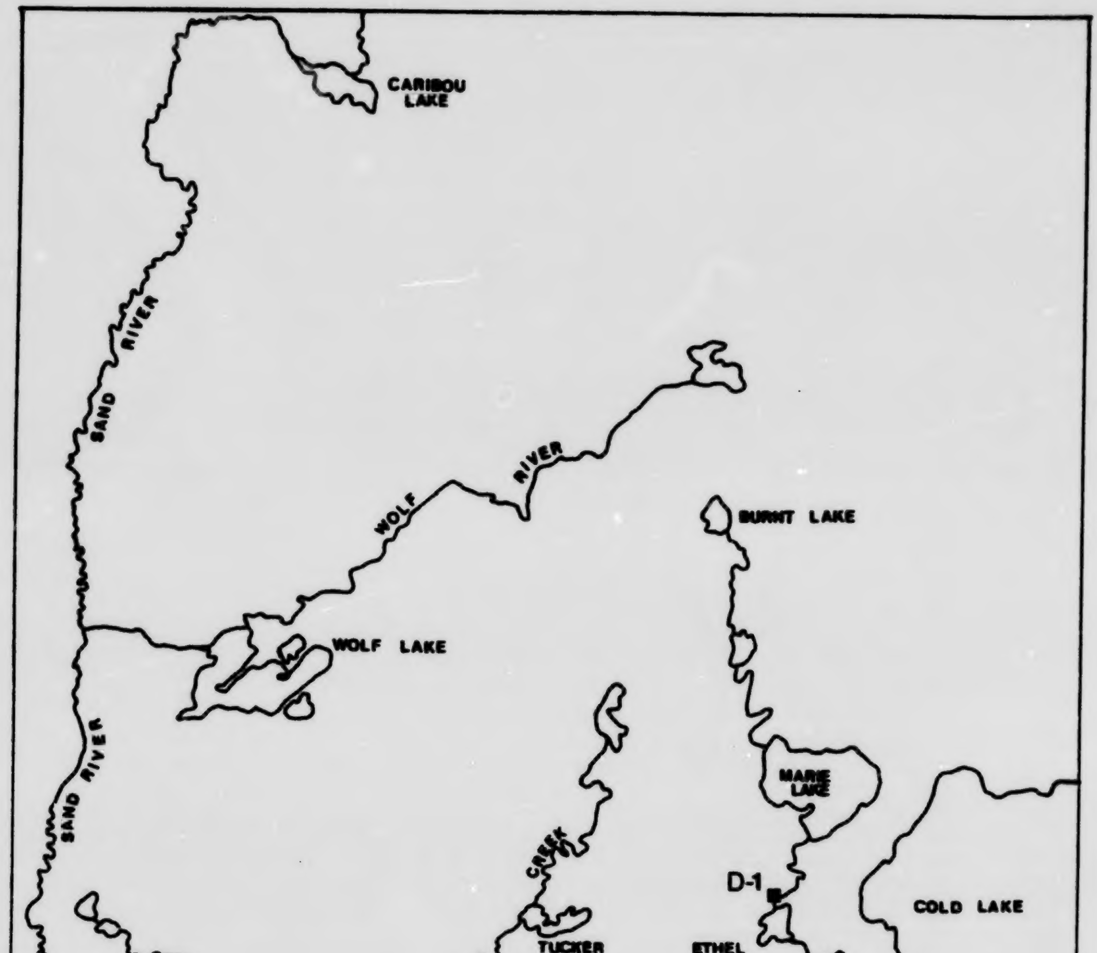
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
MARIE LAKE
D-1
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN
CR.
D-2
MARIE CREEK
BEAVER RIVER
BEAVER RIVER
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE

Figure D-1 Map showing sampling sites on Marie Creek

0 5 10 20 MILES

0 5 10 20 KM

### STREAM SITE

Site Number D-1
Stream Name Marie Creek
Location See Figure D-1

### SITE CHARACTERISTICS

| | |
|---|---|
| Bank Features | Steep bank; 1.0 - 1.5 m high,>45° angle; grasses and willows present |
| Aquatic Vegetation | 25 - 50% cover of emergent vegetation |
| Substrate Type | 90% silt/mud, 10% debris |

### SURFACE TEMPERATURE

| Date | April 24 | July 16 | October 13 |
|---|---|---|---|
| Temperature | 7°C | 20°C | 5°C |

### METHODS

| DATE | METHOD |
|---|---|
| April 24 | gillnet, minnow seine |
| July 17 | gillnet, electroshock |
| October 13 | gillnet, minnow seine |

| ELECTROSHOCKING DATA | CPsec x 100 |
|---|---|
| Northern Pike | 0.81 |
| Burbot | 0.81 |
| Total effort | 124 sec. |
| Total catch | 2 |
| Total catch/unit effort | 0.016/sec. |

FISH CAPTURES

| Species | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 400.00 | 25.00 | 4.26 | 143.09 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | 5.00 | 4.26 | 3.09 | 0.82 | | | 0.41 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | 4.89 | 2.45 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 2 hr | 20.0 hr | 23.5 hr | 15.17 hr | 122.5 m² | N.S. | 122.5 m² | 122.5m² |
| Total Catch | 8 | 6 | 2 | 5.3 | 1 | | 6 | 3.5 |
| Catch/Unit Effort | 4.00/hr | 0.300/hr | 0.085/hr | 0.349/hr | 0.008/m² | | 0.049/m² | 0.029/m² |

NS = not sampled

**STREAM SITE**

**Site Number** D-2

**Stream Name** Marie Creek

**Location** See Figure D-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| **Bank Features** | Bank < 1 m high; gentle slope; grasses and willows present |
| **Aquatic Vegetation** | 25% cover of emergent and submergent vegetation |
| **Substrate Type** | 50% sand, 25% rubble, 25% gravel |

**SURFACE TEMPERATURE**

| | | | | | |
|---|---|---|---|---|---|
| **Date** | April 24 | May 9 | May 18 | July 16 | October 13 |
| **Temperature** | 8°C | 10°C | 18°C | 20°C | 5°C |

**METHODS**

| DATE | METHOD |
|---|---|
| April 24 | gillnet |
| May 9 | electroshock |
| May 18 | gillnet |
| July 17 | gillnet, electroshock |

| ELECTROSHOCKING DATA | Spring CPsec x 100 | Summer CPsec x 100 |
|---|---|---|
| Lake chub | 4.20 | |
| Pearl dace | | 25.75 |
| White sucker | 2.10 | |
| Total effort | 667 sec. | 101 sec. |
| Total catch | 42 | 26 |
| Total catch/unit effort | 0.063/sec. | 0.257/sec. |

**FISH CAPTURES**

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 29.71 | 35.90 |  | 32.81 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 6.86 | 10.26 |  | 8.56 |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 43.75 hr | 19.5 hr | N.S. | 31.61 hr |  |  |  |  |
| Total Catch | 16 | 9 |  | 12.5 |  |  |  |  |
| Catch/Unit Effort | 0.366/hr | 0.462/hr |  | 0.396/hr |  |  |  |  |

NS = not sampled

Table D-1 Summary of catches per effort of fish taken by various methods for Marie Creek, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

|  | Gillnet |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring |  | Summer |  | Fall |  | Total Mean |  |
| Effort | 45.75 hr |  | 39.5 hr |  | 23.5 hr |  | 36.25 hr |  |
| Total Catch | 24 |  | 15 |  | 2 |  | 13.7 |  |
| Catch/Unit Effort | 0.525/hr. |  | 0.379/hr. |  | 0.085/hr. |  | 0.377/hr. |  |
|  |  |  |  |  |  |  | Means |  |
| Species | CPh x100 | % | CPh x100 | % | CPh x100 | % | CPh x100 | % |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 45.90 | 87.5 | 30.38 | 80.0 | 4.26 | 50.0 | 26.85 | 72.5 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 6.56 | 12.5 | 7.59 | 20.0 | 4.26 | 50.0 | 6.14 | 27.5 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |

**Table D-2** Summary of length-frequency data for fish captured in Marie Creek, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 1 | | 35 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | 2.9 | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | 100.0 | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | 8.6 | | | | | | | | | | | | |
| 276-300 | | | | | | | | | 20.0 | | | | | | | | | | | | |
| 301-325 | | | | | | | | | 8.6 | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 5.7 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 5.7 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 2.9 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 11.4 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 14.3 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 2.9 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 8.6 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 5.7 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | 2.9 | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table D-2 Continued.

| | | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 3 | | | | | | | | 7 | 1 | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | 100.0 | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | 100.0 | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 226-250 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 301-325 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

**Table D-2** **Concluded.**

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | 6 | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | 100.0 | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## E. MOOSELAKE RIVER

Only one sampling site (E-1) was established on the Mooselake River (Figure E-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a Stream Site sheet. Length frequency data for the Mooselake River are summarized in Table E-1.

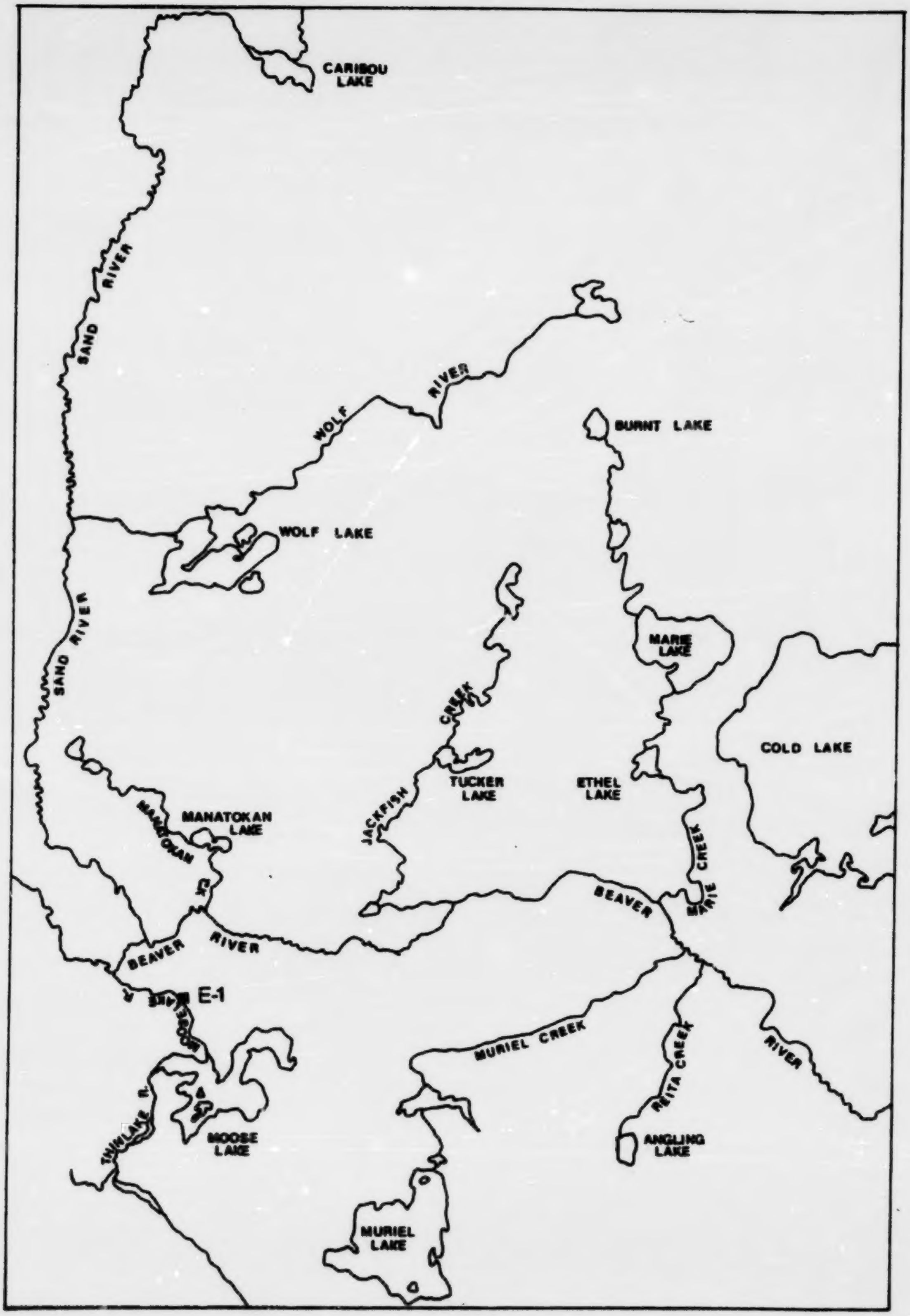
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN CK
MARIE CREEK
BEAVER
BEAVER RIVER
E-1
R.
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE

Figure E-1 Map showing sampling sites on Mooselake River

0 5 10 20 MILES
0 5 10 20 KM

### STREAM SITE

Site Number: E-1
Stream Name: Mooselake River
Location: See Figure E-1

### SITE CHARACTERISTICS

| | |
|---|---|
| Bank Features | No true bank; no slope; grasses and bush are present |
| Aquatic Vegetation | submergent vegetation |
| Substrate Type | silt, gravel and rubble |

### SURFACE TEMPERATURE

| Date | Apr 6 | Apr 23<br>May 23 | Apr 24 | Apr 25 | Apr 26 | Apr 27 | May 9 | May 10 |
|---|---|---|---|---|---|---|---|---|
| Temperature | 0°C | 11°C<br>21°C | 9°C | 10.5°C | 7.5°C | 7°C | 12°C | 9°C |

### METHODS

| DATE | METHOD |
|---|---|
| April 24 | gillnet |
| April 26 | gillnet |
| April 27 | gillnet |
| May 9 | gillnet, minnow seine |
| May 10-17, 23 | drift bomb and dipnet |

DRIFT BOMB DATA

| Date | Time | # fry | eggs |
|---|---|---|---|
| May 9 | 0630-0730 | nil | nil |
| May 10 | 1430-1530 | nil | nil |
| May 16 | 2100-2200 | nil | nil |
| May 17 | 0100-0200 | nil | nil |
| May 17 | 0600-0700 | nil | nil |
| May 17 | 1100-1200 | nil | nil |
| May 17 | 1600-1700 | nil | nil |
| May 23 (dipnet) | 1830 | some suckers | nil |

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 63.67 |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 33.47 |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 25.31 |  |  |  |  |  |  |  |
| Yellow walleye | 2.45 |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 122.5 hr | NS | NS |  | 122.5 $m^2$ | NS | NS |  |
| Total Catch | 153 |  |  |  | 0 |  |  |  |
| Catch/Unit Effort | 1.249/hr |  |  |  | 0.00/$m^2$ |  |  |  |

NS = not sampled

Table E-1 Summary of length-frequency data for fish captured in Mooselake River, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | 78 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | 1.3 | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 1.3 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 7.7 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 14.1 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 9.0 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 16.7 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 12.8 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 10.3 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 3.8 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 12.8 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 3.8 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 1.3 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | 1.3 | | | | | | | | | | | | |
| 626-650 | | | | | | | | | 2.6 | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | 1.3 | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table E-1 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | 41 | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 9.8 | | | | | | |
| 426-450 | | | | | | | | | | | | | | | 41.5 | | | | | | |
| 451-475 | | | | | | | | | | | | | | | 26.8 | | | | | | |
| 476-500 | | | | | | | | | | | | | | | 17.1 | | | | | | |
| 501-525 | | | | | | | | | | | | | | | 4.9 | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table E-1 Concluded.

| | | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | 31 | | | 3 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | 45.2 | | | | | | | | | | | | | | | |
| 151-175 | | | | | | 16.1 | | | | | | | | | | | | | | | |
| 176-200 | | | | | | 16.1 | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | 6.5 | | | | | | | | | | | | | | | |
| 251-275 | | | | | | 6.4 | | | | | | | | | | | | | | | |
| 276-300 | | | | | | 3.2 | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 33.3 | | | | | | | | | | | | |
| 376-400 | | | | | | 3.2 | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | 33.3 | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 33.3 | | | | | | | | | | | | |
| 526-550 | | | | | | 3.2 | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## F. MURIEL CREEK

A sampling site (F-1) was established on Muriel Creek; however, this stream was dry throughout the study period and no sampling was done .

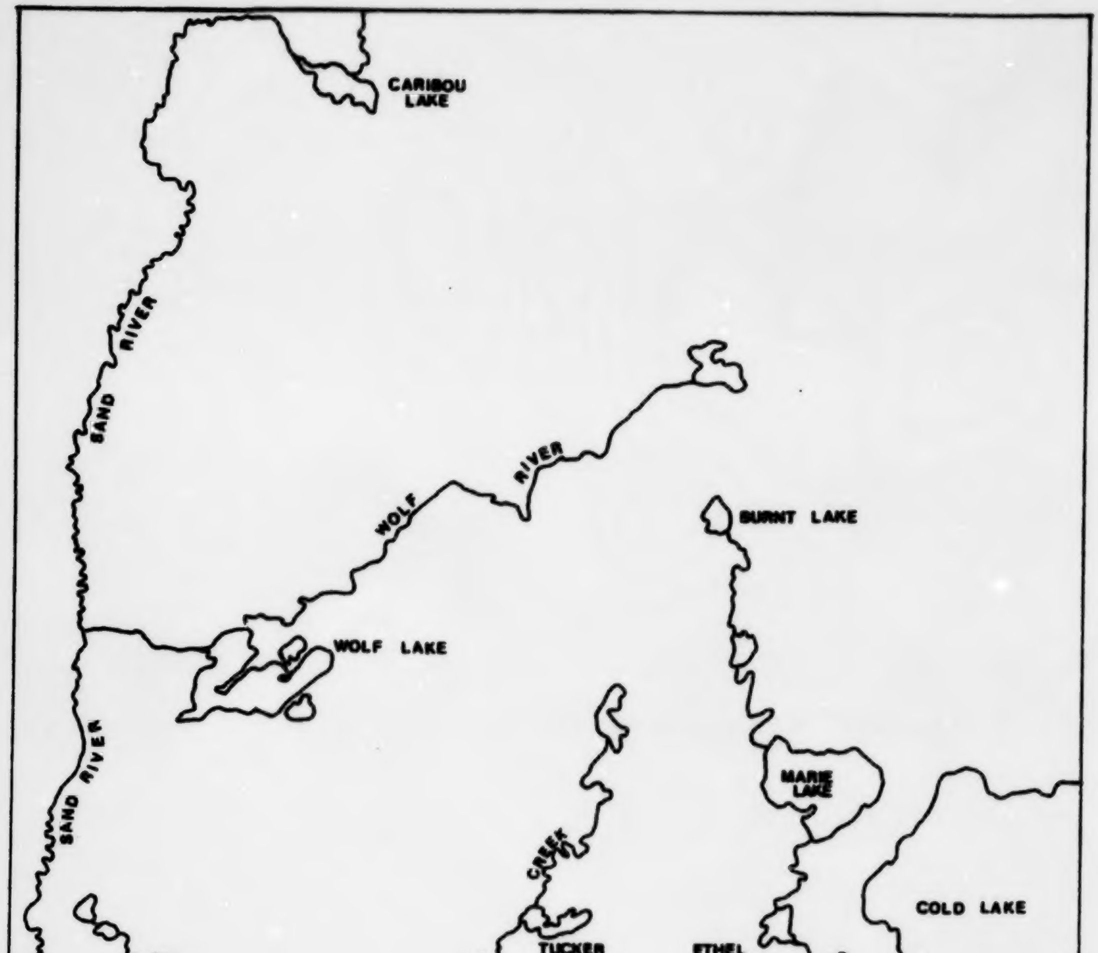
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
CREEK
COLD LAKE
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN CR.
JACKFISH
MARIE CREEK
BEAVER
BEAVER RIVER
MOOSELAKE R.
F-1
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE
0 5 10 20 MILES
0 5 10 20 KM

Figure F-1 Map showing sampling sites on Muriel Creek

## STREAM SITE

Site Number F-1

Stream Name Muriel Creek

Location See Figure F-1

## SITE CHARACTERISTICS

Bank Features

Aquatic Vegetation

Substrate Type

## SURFACE TEMPERATURE

Date

Temperature

## METHODS

Water levels were insufficient throughout the sampling period.

FISH CAPTURES

| Species | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | | | | | | | | |
| Total Catch | | | | | | | | |
| Catch/Unit Effort | | | | | | | | |

## G. REITA CREEK

One sampling site (G-1) was established on Reita Creek (Figure G-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a Stream Site sheet. Length frequency data for Reita Creek are summarized In Table G-1.

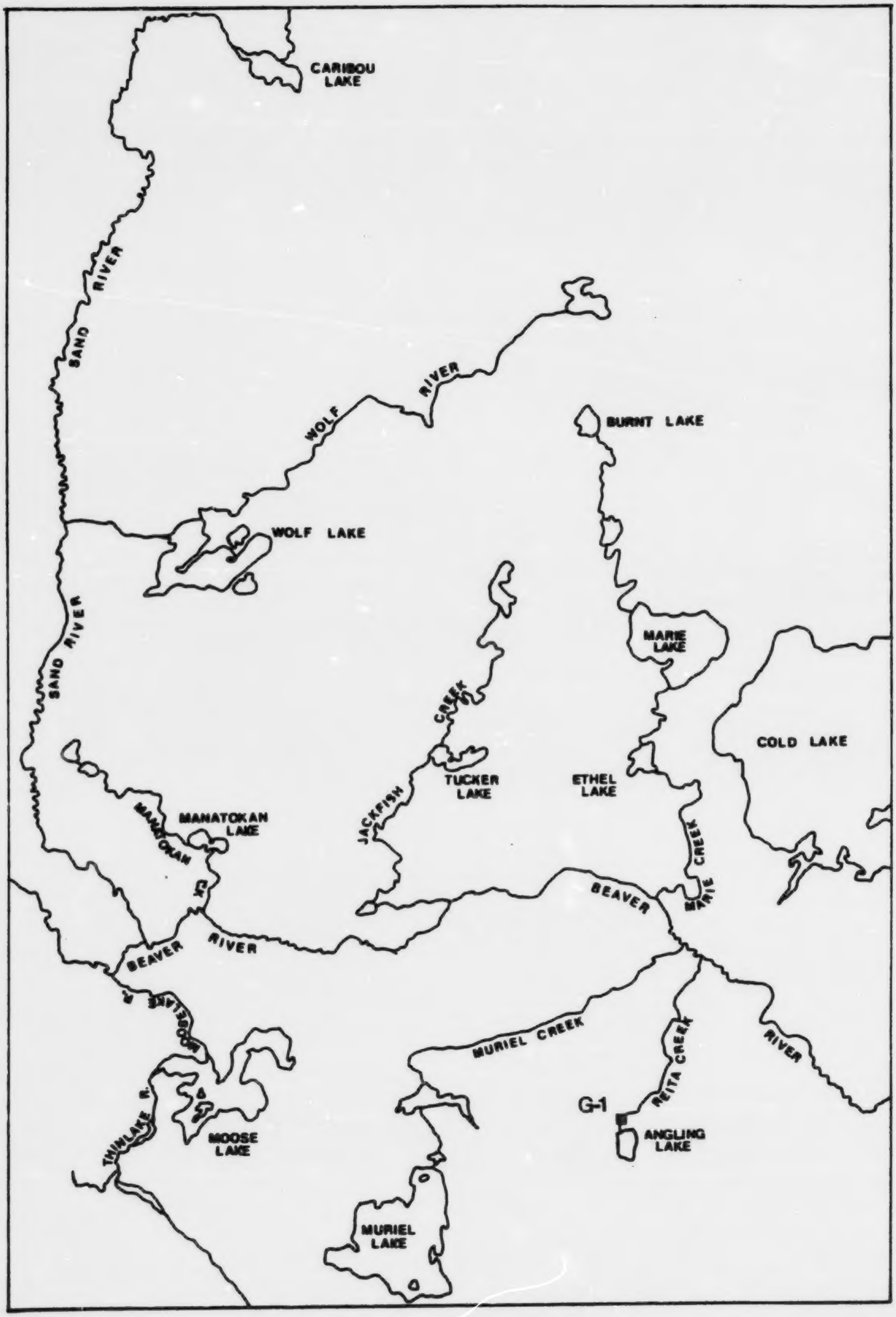
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MARIE CREEK
MANATOKAN LAKE
MANATOKAN CK.
BEAVER RIVER
BEAVER
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
RIVER
G-1
ANGLING LAKE
THINLAKE R.
MOOSE LAKE
MURIEL LAKE
0 5 10 20 MILES
0 5 10 20 KM

Figure G-1 Map showing sampling sites on Reita Creek

**STREAM SITE**

| | |
|---|---|
| Site Number | G-1 |
| Stream Name | Reita Creek |
| Location | See Figure G-1 |

**SITE CHARACTERISTICS**

| | |
|---|---|
| Bank Features | Steep bank; 1.0 - 1.5 m high; >45° slope, grasses and overhanging bushes and trees present |
| Aquatic Vegetation | nil |
| Substrate Type | 50% sand, 30% gravel, 20% boulder |

**SURFACE TEMPERATURE**

| | | |
|---|---|---|
| Date | April 28 | May 18 |
| Temperature | 9°C | 16.5°C |

**METHODS**

| DATE | METHOD |
|---|---|
| April 28 | gillnet, minnow seine |
| May 18 | minnow seine |

FISH CAPTURES

| Species | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 23.81 | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | 0.23 | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort<br>Total Catch<br>Catch/Unit Effort | 21 hr<br>5<br>0.238/hr | NS | NS | | 441.1 m$^2$<br>1<br>0.002/m$^2$ | NS | NS | |

NS = not sampled

Table G-1 Summary of length-frequency data for fish captured in Reita Creek, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | 5 | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 40.0 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 60.0 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table G-1 Continued.

| | | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table G-1 Concluded.

| | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | CN | MS | BS | CN | MS | BS | CN | MS | BS | CN | MS | BS | CN | MS | BS | CN | MS | BS | CN |
| Total Catch | | | | | | | | | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

## H. SAND RIVER

Three sampling sites (H-1 to H-3) were established on the Sand River (Figure H-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a series of numbered Stream Site sheets. Data summaries for the Sand River are presented in Table H-1 (catch-per-unit-effort) and Table H-2 (length frequencies). Tables H-3 to H-5 divide the information for each of the sampling sites into three habitat areas having slightly different characteristics.

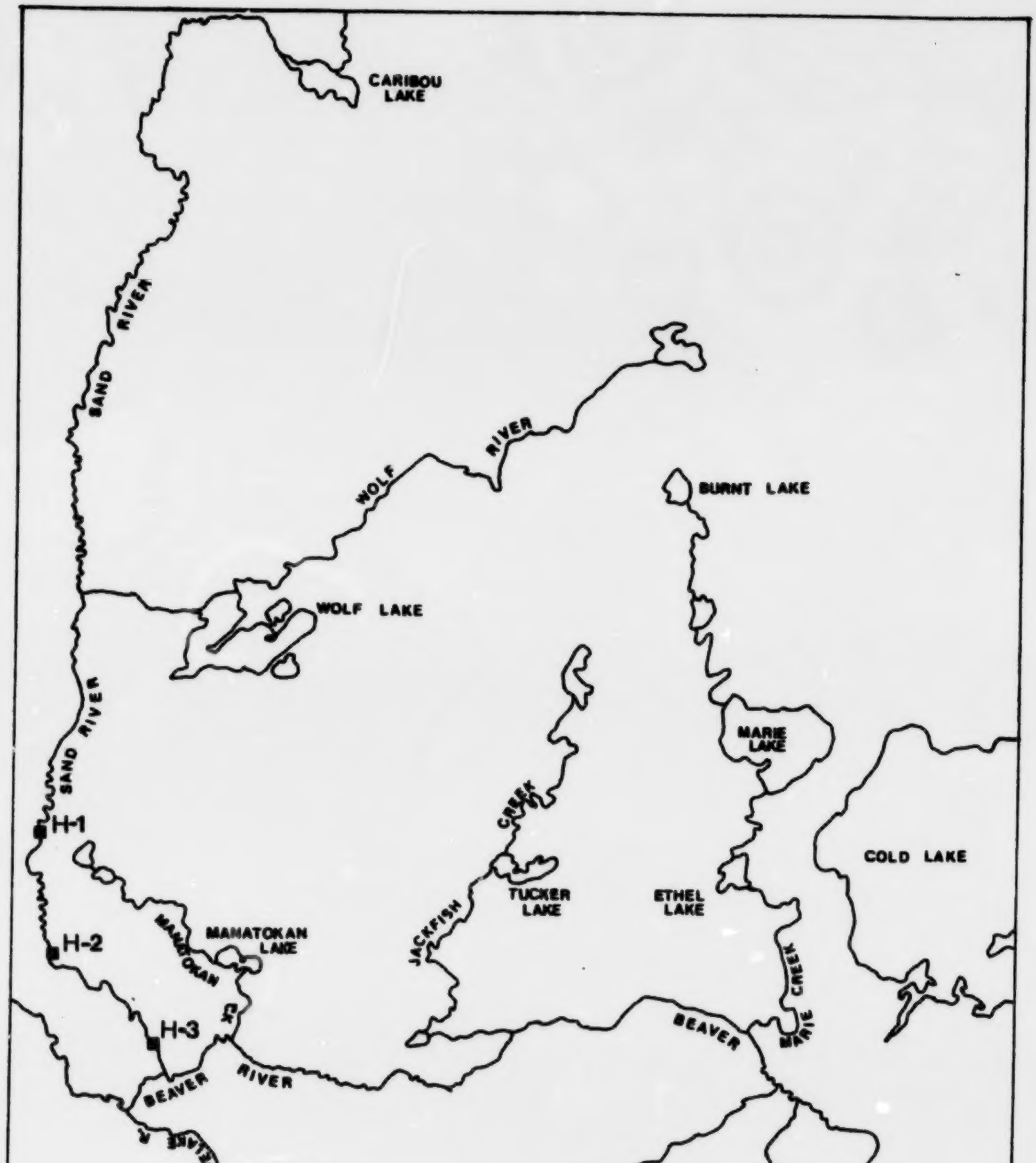
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
H-1
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN CK
H-2
H-3
BEAVER RIVER
BEAVER RIVER
MARIE CREEK
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE
0 5 10 20 MILES
0 5 10 20 KM

Figure H-1 Map showing sampling sites on the Sand River

## STREAM SITE

Site Number H-1

Stream Name Sand River

Location See Figure H-1

## SITE CHARACTERISTICS

| | |
|---|---|
| Bank Features | Steep bank, 2m high.>45° slope. Grasses and willows. |
| Aquatic Vegetation | 5-10% cover. |
| Substrate Type | Sand 85%. Gravel 10%. Organic 5%. |

## SURFACE TEMPERATURE

| Date | Apr | | | | May | | | | | Jul | Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 25 | 28 | 29 | 3 | 5 | 9 | 16 | 20 | 8 | 1 | 2 |
| Temperature | 10°C | 7 | 8 | 8.5 | 11 | 11 | 10.5 | 13 | 20 | 16 | 8 | 9 |

## METHODS

| Dates | Method | |
|---|---|---|
| Apr 26, 28, May 2-21, Jul 8, Oct 1 | Gillnet | |
| Apr 26, May 9, 15, 21, Jul 8, Oct 1 | ¶Minnow seine | See Table H- 3 |

¶Supplementary data

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 11.11 | 3.81 | 4.44 | 6.45 |  |  | 1.22 | 0.41 |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  | 0.08 |  |  | 0.03 |
| River shiner |  |  |  |  | 0.52 |  |  | 0.17 |
| Spottail shiner |  |  |  |  | 0.26 |  |  | 0.09 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  | 0.08 |  |  | 0.03 |
| Pearl dace |  |  |  |  | 0.17 | 55.51 | 2.45 | 19.38 |
| Longnose sucker | 7.41 |  | 124.44 | 43.95 | 137.19 | 1195.91 |  | 448.86 |
| White sucker | 10.58 | 3.81 | 44.44 | 19.61 |  |  | 13.48 |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  | 1.22 | 0.41 |
| Yellow walleye |  |  | 17.78 | 5.93 |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 189.0 hr | 26.25 hr | 22.5 hr | 79.25 hr | 1143.6m² | 122.5m² | 81.6m² | 449.2m² |
| Total Catch | 55 | 2 | 43 | 33.3 | 1582 | 1532 | 15 | 1043 |
| Catch/Unit Effort | 0.291/hr | 0.076/hr | 1.911/hr | 0.421/hr | 1.383/m² | 12.506/m² | 0.184/m² | 2.322/m² |

## STREAM SITE

**Site Number** H-2

**Stream Name** Sand River

**Location** See Figure H-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Bank Features** | Bank 2m high.>45° slope. Grasses and willows. |
| **Aquatic Vegetation** | 5-10% cover. |
| **Substrate Type** | Sand 100%. |

## SURFACE TEMPERATURE

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | Apr | | May | | | | | Jul | Oct | |
| | 24 | 29 | 5 | 9 | 12 | 16 | 20 | 8 | 1 | 2 |
| **Temperature** | 7°C | 8.5 | 12 | 10 | 13 | 14 | 20.5 | 16 | 8 | 8 |

## METHODS

| **Dates** | **Method** | |
|---|---|---|
| Apr 29, May 6-21, Jul 8, Oct 1 | Gillnet | |
| Apr 29, 9, 13, 22, Jul 8, Oct 1 | Minnow seine | See Table H-4 |
| May 9, 10, 22, 23 | Drift bomb | |

DRIFT BOMB DATA

| Date | Time | No. Fry | Eggs | Species |
|---|---|---|---|---|
| May 9 | 2100-2200 | Nil | Nil | |
| May 10 | 0530-0630 | Nil | Nil | |
| | 1330-1430 | Nil | Nil | |
| May 22 | 4.5 hr | 89 | X | Sucker |
| May 22/23 | 0930-1045 | 68 | X | Sucker |

FISH CAPTURES

| Species | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 2.63 | | | 0.88 | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | 2.45 | | 0.82 |
| River shiner | | | | | 3.34 | | | 1.11 |
| Spottail shiner | | | | | 1.89 | | | 0.63 |
| Fathead minnow | | | | | 10.57 | | | 3.52 |
| Longnose dace | | | | | 0.33 | | | 0.11 |
| Pearl dace | | | | | 1.00 | | | 0.33 |
| Longnose sucker | 3.51 | | | 1.17 | 0.78 | | | |
| White sucker | 13.16 | | | 4.39 | 12.02 | 1.63 | 1.84 | 5.42 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | 0.88 | | | 0.29 | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | 114 hr | 24.0m | 23 hr | 53.7 hr | 898.5m² | 122.5m² | 163.3m² | 394.8m² |
| Total Catch | 23 | 0 | 0 | 7.7 | 269 | 5 | 3 | 92.3 |
| Catch/Unit Effort | 0.202/hr | 0.00/hr | 0.00/hr | 0.143/hr | 0.299/m² | 0.041/m² | 0.018/m² | 0.234/m² |

**STREAM SITE**

Site Number H-3
Stream Name Sand River
Location See Figure H-1

**SITE CHARACTERISTICS**

| | |
|---|---|
| Bank Features | Bank 2m high.)45° slope. Grasses and willows. |
| Aquatic Vegetation | 5% cover of emergent vegetation. |
| Substrate Type | Sand 90%. Silt/mud 10%. |

**SURFACE TEMPERATURE**

| Date | Apr<br>23 | 27 | 30 | May<br>5 | 9 | 11 | 14 | 16 | 20 | Jul<br>8 | Oct<br>1 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature | 9°C | 9 | 9.5 | 10.5 | 12 | 11 | 14.5 | 14 | 19.5 | 17 | 9 | 8 |

**METHODS**

| Dates | Method | |
|---|---|---|
| Apr 27, 30, May 6-20, Jul 8, Oct 1 | Gillnet | |
| Apr 30, May 8, 14, 20, Jul 8, Oct 1 | ¶Minnow seine | See Table H-5 |
| May 20 | Drift bomb | |

DRIFT BOMB DATA

| Date | Time | No. Fry | Eggs | Species |
|---|---|---|---|---|
| May 20/21 | 1300-1230 | 250 | X | suckers |

¶Supplementary data

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 | $CPM^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 0.53 |  | 8.51 | 3.01 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  | 0.09 | 0.41 |  | 0.16 |
| Spottail shiner |  |  |  |  |  | 0.41 |  | 0.14 |
| Fathead minnow |  |  |  |  | 2.83 |  |  | 0.94 |
| Longnose dace |  |  |  |  | 0.09 | 1.63 |  | 0.57 |
| Pearl dace |  |  |  |  | 10.92 | 158.37 |  | 56.43 |
| Longnose sucker | 0.53 |  |  | 0.18 | 14.60 | 246.53 |  | 87.04 |
| White sucker | 4.81 |  |  | 1.60 | 4.52 | 29.80 |  | 11.44 |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.09 |  |  | 0.03 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye | 0.53 |  | 8.51 | 3.01 |  |  |  |  |
| Iowa darter |  |  |  |  | 0.19 |  |  | 0.06 |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 187.25 hr | 24 hr | 23.5 hr | 78.25 hr | 1061.8$m^2$ | 245.0$m^2$ | 122.5$m^2$ | 476.4$m^2$ |
| Total Catch | 12 | 0 | 4 | 5.3 | 354 | 1071 | 0 | 475 |
| Catch/Unit Effort | 0.064/hr | 0.00/hr | 0.170/hr | 0.068/hr | 0.333/$m^2$ | 4.371/$m^2$ | 0.00/$m^2$ | 0.997/$m^2$ |

Table H-1 Summary of catches per effort of fish taken by various methods for Sand River, 1981. Both catch per unit effort (x100) and percentage of total catch are indicated for each species captured. NS indicates that no sample was taken.

| | Minnow Seine | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 3103.8$m^2$ | | 490.1$m^2$ | | 367.6$m^2$ | | 1320.5$m^2$ | |
| Total Catch | 2205 | | 2609 | | 18 | | 1610.7 | |
| Catch/Unit Effort | 0.710/$m^2$ | | 5.323/$m^2$ | | 0.049/$m^2$ | | 1.219/$m^2$ | |
| | | | | | | | Means | |
| Species | $CPM^2$ x100 | % | $CPM^2$ x100 | % | $CPM^2$ x100 | % | $CPM^2$ x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | 0.27 | 5.6 | 0.09 | 1.9 |
| Lake chub | | | | | | | | |
| Emerald shiner | 0.03 | <0.1 | 0.61 | 0.1 | | | 0.21 | <0.1 |
| River shiner | 1.19 | 1.7 | 0.20 | <0.1 | | | 0.46 | 0.6 |
| Spottail shiner | 0.64 | 0.9 | 0.20 | <0.1 | | | 0.28 | 0.3 |
| Fathead minnow | 4.02 | 5.7 | | | | | 1.34 | 1.9 |
| Longnose dace | 0.16 | 0.2 | 0.81 | 0.2 | | | 0.32 | 0.1 |
| Pearl dace | 4.09 | 5.8 | 93.04 | 17.5 | 0.54 | 11.1 | 32.56 | 11.5 |
| Longnose sucker | 60.79 | 85.6 | 437.46 | 82.2 | | | 167.35 | 81.9 |
| White sucker | | | | | 3.8 | 77.8 | | |
| Burbot | | | | | | | | |
| Brook stickleback | 0.03 | <0.1 | | | | | 0.01 | <0.1 |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | | | | |
| Yellow walleye | | | | | 0.27 | 5.6 | 0.09 | 1.9 |
| Iowa darter | 0.06 | 1.0 | | | | | 0.02 | 0.3 |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Continued....

Table H-1 Concluded

| | Gillnet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | Total Mean | |
| Effort | 490.25hr | | 74.25hr | | 69.0hr | | 211.1hr | |
| Total Catch | 90 | | 2 | | 47 | | 46.3 | |
| Catch/Unit Effort | 0.184/hr | | 0.027/hr | | 0.681/hr | | 0.219/hr | |
| | | | | | | | Means | |
| Species | CPhr x100 | % | CPhr x100 | % | CPhr x100 | % | CPhr x100 | % |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | 5.09 | 27.8 | 1.34 | 50.0 | 4.34 | 6.4 | 3.59 | 28.1 |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | 3.87 | 21.1 | | | 40.57 | 59.6 | 14.81 | 26.9 |
| White sucker | 8.97 | 48.9 | 1.34 | 50.0 | 14.49 | 21.3 | 8.27 | 40.1 |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| yellow perch | | | | | | | | |
| Yellow walleye | 0.40 | 2.2 | | | 8.69 | 12.8 | 3.03 | 5.0 |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |

Table H-2 Summary of length-frequency data for fish captured in Sand River, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 1 | | 28 | | | | 3 | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | 33.3 | | | | | | | | |
| 76-100 | | | | | | | | | | | | | 66.7 | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | 100.0 | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 3.6 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 3.6 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 14.3 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 3.6 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 25.0 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 10.7 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 10.7 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | 7.1 | | | | | | | | | | | | |
| 576-600 | | | | | | | | | 3.6 | | | | | | | | | | | | |
| 601-625 | | | | | | | | | 3.6 | | | | | | | | | | | | |
| 626-650 | | | | | | | | | 3.6 | | | | | | | | | | | | |
| 651-675 | | | | | | | | | 3.6 | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | 7.1 | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Continued.....

Table H-2 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | 4 | | | 6 | | 47 | 8 | | 49 | | | | | | |
| 0-25 | | | | | | | 25.0 | | | | | | | | | | | | | | |
| 26-50 | | | | | | | 75.0 | | | | | | 12.5 | | | | | | | | |
| 51-75 | | | | | | | | | | 33.3 | | | 62.5 | | | | | | | | |
| 76-100 | | | | | | | | | | 50.0 | | | 12.5 | | | | | | | | |
| 101-125 | | | | | | | | | | 16.7 | | | 12.5 | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | 4.3 | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | 4.1 | | | | | | |
| 326-350 | | | | | | | | | | | | 8.5 | | | 2.0 | | | | | | |
| 351-375 | | | | | | | | | | | | 25.5 | | | 4.1 | | | | | | |
| 376-400 | | | | | | | | | | | | 19.2 | | | 20.4 | | | | | | |
| 401-425 | | | | | | | | | | | | 23.4 | | | 20.4 | | | | | | |
| 426-450 | | | | | | | | | | | | 19.2 | | | 30.6 | | | | | | |
| 451-475 | | | | | | | | | | | | | | | 14.3 | | | | | | |
| 476-500 | | | | | | | | | | | | | | | 4.1 | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table H-2 Concluded.

| | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | 1 | | | | | 11 | | | | | | | 7 | | | | | |
| 0-25 | | | | | | | | | | | | | | | | 42.9 | | | | | |
| 26-50 | | | | | | | | | | | | | | | | 57.1 | | | | | |
| 51-75 | | | | 100.0 | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | 18.2 | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 18.2 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 9.1 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 9.1 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 27.3 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 9.1 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 9.1 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table H - 3 Summary of catches per effort of fish taken by minnow seining in various habitats for Sand River, Site H-1. Catch per unit effort (x100) is indicated for each species captured. NS indicates that no sample was taken.

| | Main Channel | | | Riffle | | | Backwater | | |
|---|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Spring | Summer | Fall | Spring | Summer | Fall |
| Effort | 367.6m² | | | 367.6m² | 40.84m² | | 408.4m² | 81.6m² | 81.6m² |
| Total Catch | 23 | NS | NS | 32 | 13 | NS | 1527 | 1520 | 15 |
| Catch/unit Effort | 0.063/m² | | | 0.087/m² | 0.318/m² | | 3.739/m² | 18.627/m² | 0.184/m² |
| Species | CPM² x 100 | CPM² x 100 | CPM² x 100 | CPM² x 100 | CPM² x 100 | CPM² x 100 | CPM² x 100 | CPM² x 100 | CPM² x 100 |
| Lake whitefish | | | | | | | | | |
| Lake cisco | | | | | | | | | |
| Northern pike | | | | | | | | | 1.22 |
| Lake chub | | | | | | | | | |
| Emerald shiner | | | | 0.27 | | | | | |
| River shiner | 1.63 | | | | | | | | |
| Spottail shiner | 0.54 | | | 0.27 | | | | | |
| Fathead minnow | | | | | | | | | |
| Longnose dace | 0.27 | | | | | | | | |
| Pearl dace | | | | | 2.45 | | 0.49 | 82.11 | 2.45 |
| Longnose sucker | 0.27 | | | 4.89 | } 29.38 | | } 373.40 | } 178.06 | |
| White sucker | 3.54 | | | 3.26 | | | | | 13.48 |
| Burbot | | | | | | | | | |
| Brook stickleback | | | | | | | | | |
| Ninespine stickleback | | | | | | | | | |
| Yellow perch | | | | | | | | | 1.22 |
| Yellow walleye | | | | | | | | | |
| Iowa dater | | | | | | | | | |
| Logperch | | | | | | | | | |
| Slimy sculpin | | | | | | | | | |

Table H-4 Summary of catches per effort of fish taken by minnow seining in various habitats for Sand River, Site H-2. Catch per unit effort (x100) is indicated for each species captured. NS indicates that no sample was taken.

| | Main Channel | | | Riffle | | | Backwater | | |
|---|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Spring | Summer | Fall | Spring | Summer | Fall |
| Effort | 571.8$m^2$ | 122.5$m^2$ | 40.84$m^2$ | 1 22.5$m^2$ | NS | NS | 204.2$m^2$ | NS | 122.5$m^2$ |
| Total Catch | 100 | 5 | 1 | 5 | | | 164 | | 2 |
| Catch/unit Effort | 0.175/$m^2$ | 0.041/$m^2$ | 0.025/$m^2$ | 0.041/$m^2$ | | | 0.803/$m^2$ | | 0.016/$m^2$ |
| **Species** | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 |
| Lake whitefish | | | | | | | | | |
| Lake cisco | | | | | | | | | |
| Northern pike | | | | | | | | | |
| Lake chub | | | | | | | | | |
| Emerald shiner | | 2.45 | | | | | | | |
| River shiner | 5.25 | | | | | | | | |
| Spottail shiner | 0.35 | | | | | | 7.35 | | |
| Fathead minnow | | | | | | | 46.52 | | |
| Longnose dace | 0.52 | | | | | | | | |
| Pearl dace | 1.57 | | | | | | | | |
| Longnose sucker | 0.52 | 1.63 | | 0.82 | | | 1.47 | | |
| White sucker | 9.27 | | 2.45 | 3.27 | | | 24.98 | | 1.63 |
| Burbot | | | | | | | | | |
| Brook stickleback | | | | | | | | | |
| Ninespine stickleback | | | | | | | | | |
| Yellow perch | | | | | | | | | |
| Yellow walleye | | | | | | | | | |
| Iowa dater | | | | | | | | | |
| Logperch | | | | | | | | | |
| Slimy sculpin | | | | | | | | | |

Table H-5 Summary of catches per effort of fish taken by minnow seining in various habitats for Sand River, Site H-3. Catch per unit effort (x100) is indicated for each species captured. NS indicates that no sample was taken.

| | Main Channel | | | Riffle | | | Backwater | | |
|---|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Spring | Summer | Fall | Spring | Summer | Fall |
| Effort | 490.2m$^2$ | 122.5m$^2$ | 122.5m$^2$ | 245.0m$^2$ | 122.5m$^2$ | | 326.7m$^2$ | | |
| Total Catch | 228 | 72 | NS | 6 | 999 | NS | 120 | NS | NS |
| Catch/unit Effort | 0.465/m$^2$ | 0.588/m$^2$ | 0.00/m$^2$ | 0.025/m$^2$ | 8.155/m$^2$ | | 0.367/m$^2$ | | |
| Species | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 |
| Lake whitefish | | | | | | | | | |
| Lake cisco | | | | | | | | | |
| Northern pike | | | | | | | | | |
| Lake chub | | | | | | | | | |
| Emerald shiner | | | | | | | | | |
| River shiner | 0.20 | 0.82 | | | | | | | |
| Spottail shiner | | 0.82 | | | | | | | |
| Fathead minnow | 0.82 | | | | | | 7.96 | | |
| Longnose dace | | 3.27 | | 0.42 | | | | | |
| Pearl dace | 23.46 | 25.31 | | 0.42 | 291.43 | | | | |
| Longnose sucker | 12.85 | 26.94 | | | 466.12 | | 28.16 | | |
| White sucker | 8.77 | 1.63 | | 1.63 | 57.96 | | 0.31 | | |
| Burbot | | | | | | | | | |
| Brook stickleback | | | | | | | 0.31 | | |
| Ninespine stickleback | | | | | | | | | |
| Yellow perch | | | | | | | | | |
| Yellow walleye | | | | | | | | | |
| Iowa dater | 0.41 | | | | | | | | |
| Logperch | | | | | | | | | |
| Slimy sculpin | | | | | | | | | |

# I. THINLAKE RIVER

Only one sampling site (I-1) was established on the Thinlake River (Figure I-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on a Stream Site sheet. Length frequency data for the Thinlake River are summarized in Table I-1 and catch-per-unit-effort data for three habitat types are presented in Table I-2.

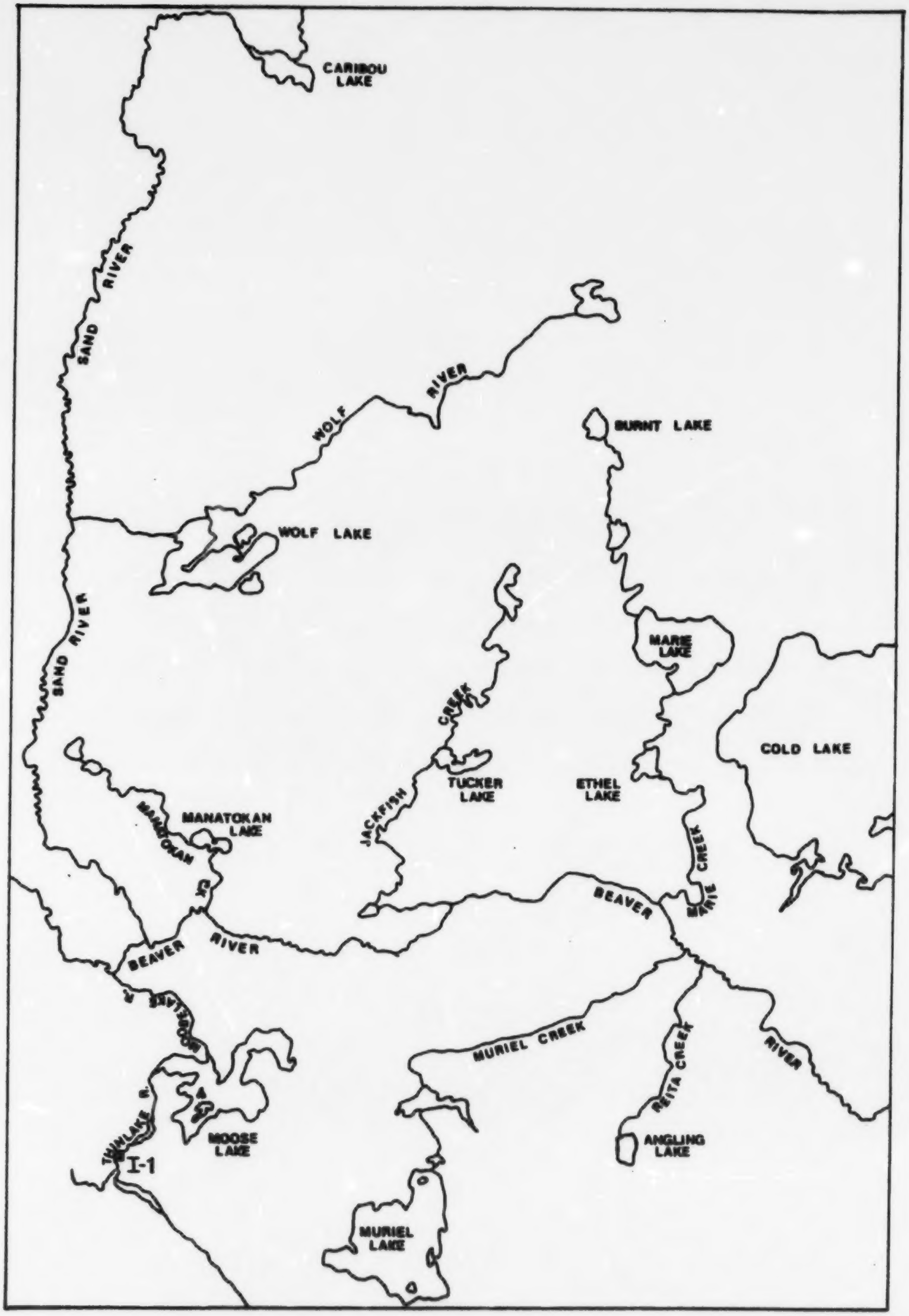
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN CK
MARIE CREEK
BEAVER
BEAVER RIVER
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
I-1
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE
0 5 10 20 MILES
0 5 10 20 KM

Figure I-1 Map showing sampling sites on the Thinlake River

## STREAM SITE

**Site Number** I-1

**Stream Name** Thinlake River

**Location** See Figure I-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Bank Features** | Steep bank; 2 m high with a>45° angle; grasses and willows present |
| **Aquatic Vegetation** | nil |
| **Substrate Type** | 100% silt/mud |

## SURFACE TEMPERATURE

| **Date** | **April 6** | **April 24** | **April 25** | **May 15** | **July 9** | **October 3** |
|---|---|---|---|---|---|---|
| **Temperature** | 1°C | 6°C | 5.5°C | 10.5°C | 11°C | 1°C |

## METHODS

| DATE | METHOD |
|---|---|
| April 24 | ¶ minnow seine, gillnet (see Table I-2) |
| May 14 | minnow seine, gillnet |
| July 9 | minnow seine, gillnet |
| October 3 | minnow seine, gillnet |

¶ Supplementary data

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x10C | CPH x100 | CPH x100 | CPM² x100 | CPM² x100 | CPM² x100 | CPM² x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 42.35 | 4.08 | 80.00 | 42.14 |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  | 0.49 |  | 0.82 | 0.44 |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 25.88 | 12.24 |  | 12.71 |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  | 0.16 |  |  | 0.05 |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch | 61.18 | 183.67 |  | 81.61 | 1.80 |  |  | 0.60 |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 42.5 hr | 24.5 hr | 25 hr | 30.7 hr | 612.6 m² | 122.5 m² | 122.5 m² | 285.9 m² |
| Total Catch | 55 | 49 | 2 | 35.3 | 15 | 0 | 1 | 5.3 |
| Catch/Unit Effort | 1.294/hr | 2.000/hr | 0.080/hr | 1.150/hr | 0.025/m² | 0.000/m² | 0.008/m² | 0.019/m² |

Table I-1 Summary of length-frequency data for fish captured in Thinlake River, 1981. Total catch represents number captured, length-frequencies are expressed in percentages.

| | LKWT | | | LKCS | | | PIKE | | | LKCB | | | EMSH | | | RVSH | | | SPSH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | 18 | | | | | | | | | | 1 | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | 100.0 | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | 5.6 | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | 11.1 | | | | | | | | | | | | |
| 351-375 | | | | | | | | | 11.1 | | | | | | | | | | | | |
| 376-400 | | | | | | | | | 11.1 | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | 11.1 | | | | | | | | | | | | |
| 451-475 | | | | | | | | | 5.6 | | | | | | | | | | | | |
| 476-500 | | | | | | | | | 22.2 | | | | | | | | | | | | |
| 501-525 | | | | | | | | | 16.7 | | | | | | | | | | | | |
| 526-550 | | | | | | | | | 5.6 | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-625 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table I-1 Continued.

| | FHMW | | | LNDC | | | PLDC | | | LNSK | | | WTSK | | | BURB | | | BRST | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | | | | | | | | | | 10 | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | | | | | | | | | | | | | | | | |
| 151-175 | | | | | | | | | | | | | | | | | | | | | |
| 176-200 | | | | | | | | | | | | | | | | | | | | | |
| 201-225 | | | | | | | | | | | | | | | 10.0 | | | | | | |
| 226-250 | | | | | | | | | | | | | | | | | | | | | |
| 251-275 | | | | | | | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | 30.0 | | | | | | |
| 401-425 | | | | | | | | | | | | | | | 30.0 | | | | | | |
| 426-450 | | | | | | | | | | | | | | | 20.0 | | | | | | |
| 451-475 | | | | | | | | | | | | | | | 10.0 | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table I-1 Concluded.

| | NSST | | | YWPH | | | WALL | | | IODR | | | LGPH | | | UNSK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN | MS | BS | GN |
| Total Catch | | | | | | 71 | | | | | | | | | | | | | | | |
| 0-25 | | | | | | | | | | | | | | | | | | | | | |
| 26-50 | | | | | | | | | | | | | | | | | | | | | |
| 51-75 | | | | | | | | | | | | | | | | | | | | | |
| 76-100 | | | | | | | | | | | | | | | | | | | | | |
| 101-125 | | | | | | | | | | | | | | | | | | | | | |
| 126-150 | | | | | | 52.1 | | | | | | | | | | | | | | | |
| 151-175 | | | | | | 35.2 | | | | | | | | | | | | | | | |
| 176-200 | | | | | | 7.0 | | | | | | | | | | | | | | | |
| 201-225 | | | | | | 2.8 | | | | | | | | | | | | | | | |
| 226-250 | | | | | | 1.4 | | | | | | | | | | | | | | | |
| 251-275 | | | | | | 1.4 | | | | | | | | | | | | | | | |
| 276-300 | | | | | | | | | | | | | | | | | | | | | |
| 301-325 | | | | | | | | | | | | | | | | | | | | | |
| 326-350 | | | | | | | | | | | | | | | | | | | | | |
| 351-375 | | | | | | | | | | | | | | | | | | | | | |
| 376-400 | | | | | | | | | | | | | | | | | | | | | |
| 401-425 | | | | | | | | | | | | | | | | | | | | | |
| 426-450 | | | | | | | | | | | | | | | | | | | | | |
| 451-475 | | | | | | | | | | | | | | | | | | | | | |
| 476-500 | | | | | | | | | | | | | | | | | | | | | |
| 501-525 | | | | | | | | | | | | | | | | | | | | | |
| 526-550 | | | | | | | | | | | | | | | | | | | | | |
| 551-575 | | | | | | | | | | | | | | | | | | | | | |
| 576-600 | | | | | | | | | | | | | | | | | | | | | |
| 601-625 | | | | | | | | | | | | | | | | | | | | | |
| 626-650 | | | | | | | | | | | | | | | | | | | | | |
| 651-675 | | | | | | | | | | | | | | | | | | | | | |
| 676-700 | | | | | | | | | | | | | | | | | | | | | |
| 701-725 | | | | | | | | | | | | | | | | | | | | | |
| 726-750 | | | | | | | | | | | | | | | | | | | | | |
| 751-775 | | | | | | | | | | | | | | | | | | | | | |
| 776-800 | | | | | | | | | | | | | | | | | | | | | |
| 801-825 | | | | | | | | | | | | | | | | | | | | | |

Table I-2 Summary of catches per effort of fish taken in various habitats for Thinlake River (Site I-1). Catch per unit effort (x 100) is indicated for each species captured.

|  | Main Channel | Slackwater | Riffle |
|---|---|---|---|
| Effort | 204.2 m$^2$ | 204.2 m$^2$ | 204.2 m$^2$ |
| Total Catch | 3 | 10 | 2 |
| Catch/Unit Effort | 0.015/m$^2$ | 0.049/m$^2$ | 0.009/m$^2$ |
| Species | CPM$^2$ x 100 | CPM$^2$ x 100 | CPM$^2$ x 100 |
| Lake whitefish |  |  |  |
| Lake cisco |  |  |  |
| Northern pike |  |  |  |
| Lake chub |  |  |  |
| Emerald shiner |  |  |  |
| River shiner |  |  |  |
| Spottail shiner | 0.98 | 0.49 |  |
| Fathead minnow |  |  |  |
| Longnose dace |  |  |  |
| Pearl dace |  |  |  |
| Longnose sucker |  |  |  |
| White sucker |  |  |  |
| Burbot |  |  |  |
| Brook stickleback |  | 0.49 |  |
| Ninespine stickleback |  |  |  |
| Yellow perch | 0.49 | 3.92 | 0.98 |
| Yellow walleye |  |  |  |
| Iowa darter |  |  |  |
| Logperch |  |  |  |
| Slimy sculpin |  |  |  |

# J. WOLF RIVER

Two sampling sites (J-1 and J-2) were established on the Wolf River, one at the inflow and one at the outflow of Wolf Lake (Figure J-1). Information on site characteristics, surface water temperatures, methods, and fish catches is presented on Stream Site sheets.

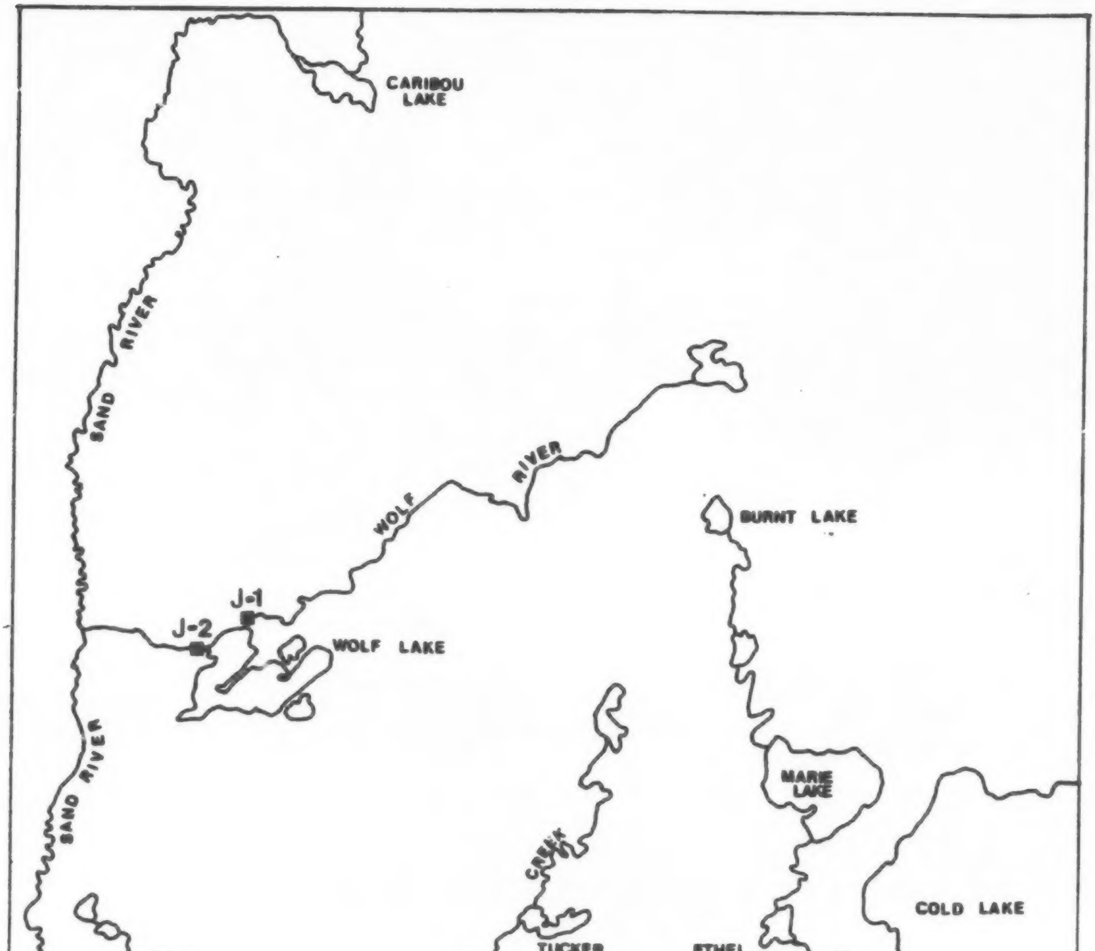
CARIBOU LAKE
SAND RIVER
WOLF RIVER
BURNT LAKE
J-1
J-2
WOLF LAKE
SAND RIVER
MARIE LAKE
COLD LAKE
JACKFISH CREEK
TUCKER LAKE
ETHEL LAKE
MANATOKAN LAKE
MANATOKAN R.
MARIE CREEK
BEAVER RIVER
BEAVER RIVER
MOOSELAKE R.
MURIEL CREEK
REITA CREEK
RIVER
THINLAKE R.
MOOSE LAKE
ANGLING LAKE
MURIEL LAKE
0
5
10
20
MILES
0
5
10
20
KM

Figure J-1 Map showing sampling sites on the Wolf River

## STREAM SITE

Site Number J-1

Stream Name Wolf River (inflow)

Location See Figure J-1

## SITE CHARACTERISTICS

Bank Features

Aquatic Vegetation

Substrate Type

## SURFACE TEMPERATURE

| | | |
|---|---|---|
| Date | May 18/19 | May 26/27 |
| Temperature | 13.5°C | 18°C |

## METHODS

Drift bombs were placed near the mouth of the lake May 18-19 and May 26-27 to monitor downstream fry migration.

| Date | Time | # fry | eggs | species |
|---|---|---|---|---|
| May 18 | 1800-2145 | nil | X | walleye & sucker |
| May 18/19 | 2145-0600 | nil | X | walleye & sucker |
| May 19 | 0600-1000 | nil | X | walleye & sucker |
| May 19 | 1000-1400 | nil | X | walleye & sucker |
| May 19 | 1400-1600 | nil | X | walleye & sucker |
| May 26/27 | 1400-1800 | nil | X | walleye & sucker |

FISH CAPTURES

| | Gillnet | | | | Minnow Seine | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
| Species | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish | | | | | | | | |
| Lake cisco | | | | | | | | |
| Northern pike | | | | | | | | |
| Lake chub | | | | | | | | |
| Emerald shiner | | | | | | | | |
| River shiner | | | | | | | | |
| Spottail shiner | | | | | | | | |
| Fathead minnow | | | | | | | | |
| Longnose dace | | | | | | | | |
| Pearl dace | | | | | | | | |
| Longnose sucker | | | | | | | | |
| White sucker | | | | | | | | |
| Burbot | | | | | | | | |
| Brook stickleback | | | | | | | | |
| Ninespine stickleback | | | | | | | | |
| Yellow perch | | | | | | | | |
| Yellow walleye | | | | | | | | |
| Iowa darter | | | | | | | | |
| Logperch | | | | | | | | |
| Slimy sculpin | | | | | | | | |
| Total Effort | | | | | | | | |
| Total Catch | | | | | | | | |
| Catch/Unit Effort | | | | | | | | |

## STREAM SITE

**Site Number** J-2

**Stream Name** Wolf River (outflow)

**Location** See Figure J-1

## SITE CHARACTERISTICS

| | |
|---|---|
| **Bank Features** | No slope, grasses present |
| **Aquatic Vegetation** | flooded grasses |
| **Substrate Type** | 60% silt/sand, 40% rubble |

## SURFACE TEMPERATURE

| | | | |
|---|---|---|---|
| **Date** | April 7 | May 18/19 | May 26/27 |
| **Temperature** | 4°C | 11°C | 19.5°C |

## METHODS

| DATE | METHOD |
|---|---|
| May 3 | gillnet |
| May 18 | drift bomb |
| May 26 | drift bomb |

Drift bombs were placed near the outflow of Wolf Lake to monitor downstream fry migration.

| Date | Time | # fry | eggs | species |
|---|---|---|---|---|
| May 18 | 1830-2100 | nil | X | walleye & sucker |
| May 18 | 2100-0500 | nil | X | walleye & sucker |
| May 19 | 0500-0930 | nil | X | walleye & sucker |
| May 19 | 0930-1315 | nil | X | walleye & sucker |
| May 19 | 1315-1630 | nil | X | walleye & sucker |
| May 26/27 | 1330-1730 | 4 (3 WTSK)<br>(1 WALL) | X | walleye & sucker |

FISH CAPTURES

| Species | Gillnet |  |  |  | Minnow Seine |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | Spring | Summer | Fall | Mean | Spring | Summer | Fall | Mean |
|  | CPH x100 | CPH x100 | CPH x100 | CPH x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 | CPM$^2$ x100 |
| Lake whitefish |  |  |  |  |  |  |  |  |
| Lake cisco |  |  |  |  |  |  |  |  |
| Northern pike | 62.50 |  |  |  |  |  |  |  |
| Lake chub |  |  |  |  |  |  |  |  |
| Emerald shiner |  |  |  |  |  |  |  |  |
| River shiner |  |  |  |  |  |  |  |  |
| Spottail shiner |  |  |  |  |  |  |  |  |
| Fathead minnow |  |  |  |  |  |  |  |  |
| Longnose dace |  |  |  |  |  |  |  |  |
| Pearl dace |  |  |  |  |  |  |  |  |
| Longnose sucker |  |  |  |  |  |  |  |  |
| White sucker | 4.17 |  |  |  |  |  |  |  |
| Burbot |  |  |  |  |  |  |  |  |
| Brook stickleback |  |  |  |  |  |  |  |  |
| Ninespine stickleback |  |  |  |  |  |  |  |  |
| Yellow perch |  |  |  |  |  |  |  |  |
| Yellow walleye |  |  |  |  |  |  |  |  |
| Iowa darter |  |  |  |  |  |  |  |  |
| Logperch |  |  |  |  |  |  |  |  |
| Slimy sculpin |  |  |  |  |  |  |  |  |
| Total Effort | 24 hr | N.S. | N.S. |  |  |  |  |  |
| Total Catch | 16 |  |  |  |  |  |  |  |
| Catch/Unit Effort | 0.667/hr |  |  |  |  |  |  |  |

NS = not sampled